
PART D
MATERIALS HANDLING AND STORAGE, INCLUDING CRANES, DERRICKS, ETC., AND RIGGING

WAC

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WAC 296-24-215 Materials handling and storage-Handling materials-General.

[Order 73-5, § 296-24-215, filed 5/9/73 and Order 73-4, § 296-24-215, filed 5/7/73.]

WAC 296-24-21501 Use of mechanical equipment. Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, through doorways and wherever turns or passage must be made. Aisles and passageways shall be kept clear and in good repair, with no obstruction across or in aisles that could create a hazard. Permanent aisles and passageways shall be appropriately marked.

[Order 73-5, § 296-24-21501, filed 5/9/73 and Order 73-4, § 296-24-21501, filed 5/7/73.]

WAC 296-24-21509 Clearance limits. Clearance signs to warn of clearance limits shall be provided.

[Order 73-5, § 296-24-21509, filed 5/9/73 and Order 73-4, § 296-24-21509, filed 5/7/73.]

WAC 296-24-21511 Rolling railroad cars.

- (1) Derail and/or bumper blocks shall be provided on spur railroad tracks where a rolling car could contact other cars being worked, enter a building, work or traffic area. This does not apply to cars being moved by a locomotive, switch engine, donkey engine, or a car puller, but only to cars which are "cut loose." The standard does not apply to "cut loose" cars in railroad yards where trains are made up using gravity feed arrangements.
- (2) A clearly audible warning system shall be employed when cars are being moved by car pullers or locomotives, and when the person responsible for the moving does not have assurance that the area is clear, and it is safe to move the car or cars.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-24-21511, filed 5/15/89, effective 6/30/89; Order 74-27, § 296-24-21511, filed 5/7/74; Order 73-5, § 296-24-21511, filed 5/9/73 and Order 73-4, § 296-24-21511, filed 5/7/73.]

WAC 296-24-21513 Guarding. Covers and/or guardrails shall be provided to protect personnel from the hazards of open pits, tanks, vats, ditches, etc.

[Order 73-5, § 296-24-21513, filed 5/9/73 and Order 73-4, § 296-24-21513, filed 5/7/73.]

WAC 296-24-21515 Conveyors. Conveyors shall be constructed operated and maintained in accordance with the provisions of ANSI B 20.1-1957. The following additional provisions shall also apply where applicable.

- (1) When the return strand of a conveyor operates within seven feet of the floor there shall be a trough provided of sufficient strength to carry the weight resulting from a broken chain.
- (2) If the strands are over a passageway a means shall be provided to catch and support the ends of the chain in the event of a break.
- (3) When the working strand of a conveyor crosses within three feet of the floor level in passageways, the trough in which it works shall be bridged the full width of the passageway.
- (4) Whenever conveyors pass adjacent to or over working areas or passageways used by personnel, protective guards shall be installed. These guards shall be designed to catch and hold any load or materials which may fall off or become dislodged and injure a worker.
- (5) Walking on rolls prohibited. Employees shall not be allowed to walk on the rolls of roller-type conveyors except for emergency.
- (6) Guarding shaftway and material entrances of elevator type conveyors. Guards, screens or barricades of sufficient strength and size to prevent material from falling shall be installed on all sides of the shaftway of elevator-type conveyors except at openings where material is loaded or unloaded. Automatic shaftway gates or suitable barriers shall be installed at each floor level where material is loaded or unloaded from the platform.

WAC 296-24-21515 (Cont.)

- (7) Emergency conveyor stops. Conveyors shall be provided with an emergency stopping device which can be reached from the conveyor. Such device shall be located near the material entrance to each barker, chipper, saw, or similar type of equipment except where the conveyor leading into such equipment is under constant control of an operator who has full view of the material entrance and is located where the operator cannot possibly fall onto the conveyor.
- (8) Safe access to conveyors. Where conveyors are in excess of 7' in height, means shall be provided to safely permit essential inspection and maintenance operations.
- (9) Worn parts. Any part showing signs of significant wear shall be inspected carefully and replaced prior to reaching a condition where it may create a hazard.
- (10) Replacement of parts. Replacement parts shall be equal to or exceed the manufacturer's specifications.
[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-21515, filed 7/20/94, effective 9/20/94; Order 74-27, § 296-24-21515, filed 5/7/74; Order 73-5, § 296-24-21515, filed 5/9/73 and Order 73-4, § 296-24-21515, filed 5/7/73.]

WAC 296-24-233 Motor vehicle trucks and trailers.

- (1) Only qualified drivers shall be permitted to operate motor vehicle trucks, and shall possess a current motor vehicle operator's license.
- (2) Motor vehicle trucks must be equipped with brakes which will safely hold the maximum load on maximum grades.
- (3) Trailers must be equipped with good, workable air brakes, or other type of brake equipment approved by the state commission on equipment. Air must be cut into the trailer brake system at the time that the trailer is coupled to the truck.
- (4) Brakes on trucks and trailers must be tested before equipment descends a steep grade.
- (5) Truck drivers shall at all times operate equipment at a safe speed for roadway conditions.
- (6) Safe methods of loading and unloading motor vehicle trucks and trailers shall be observed at all times.
- (7) To prevent accidents during the backing of trucks where vision is obstructed, a signalperson shall be stationed at a point giving a clear view of the rear of the truck and the operator of the truck at all times.
- (8) Truck drivers shall sound their horn before starting to back, and shall sound the horn intermittently during the entire backing operation.
- (9) Dump trucks shall have a device installed on the frame which will be of sufficient strength to hold the bed in the raised position when employees are working in an exposed position underneath.
- (10) All parts and accessories of trucks and trailers shall be kept in good repair and safe condition. Tires worn beyond the point of safety shall not be used.

WAC 296-24-233 (Cont.)

- (11) All motor vehicle trucks and trailers shall be equipped with standard lights, horn, flags, flares, etc., to conform to the state of Washington motor vehicles laws.
- (12) All loads transported on trucks and/or trucks and trailers shall be properly secured and distributed, and limited to a safe operating load for the condition of the roadway, and the capacity of the bridges, trestles, and other structures.
- (13) Trucks parked on an incline shall have the steered wheels turned into the curb and shall have at least one "driver" wheel chocked on each side, independent of the braking system.
- (14) Motor vehicles used regularly for transportation of workers shall be well equipped, covered against the weather and maintained in good mechanical condition at all times.
 - (a) Seats, which shall be properly secured, shall be provided in each vehicle to accommodate the total number of workers normally transported. Where it becomes necessary under emergency conditions to transport more workers than the seating capacity of the truck will accommodate, all workers not having seats shall ride within the vehicle. Under no circumstances shall workers ride on fenders or running boards of the vehicle.
 - (b) No workers shall ride in or on any vehicle with legs hanging over the end or sides. A safety bar should be placed across the rear opening of all trucks carrying workers which are not equipped with tail gates.
 - (c) Vehicles shall be equipped with compartments or screen of such strength to retain sharp tools which could present a hazard to employees being transported.
 - (d) All dump-trucks used to transport workers shall be equipped with an adequate safety chain or locking device which will eliminate the possibility of the body of the truck being raised while workers are riding in the truck.
 - (e) Explosives or highly inflammable materials shall not be carried in or on any vehicle while it is used to transport workers.
 - (f) Exhaust systems shall be installed and maintained in proper condition, and shall be so designed as to eliminate the exposure of the workers to the exhaust gases and fumes.
 - (g)(i) The number of persons allowed in the cab of a single bench seat crew truck shall not exceed two in addition to the driver. Crew trucks designed and constructed with additional seating capacity behind the normal driver's seat may carry additional passengers in the seating area behind the driver's seat. Crew trucks with bucket-type seats may carry only the number of passengers for which the bucket seats are provided. In any seating arrangement, the driver must be able to maintain full freedom of motion. Additionally, the number of passengers or seating arrangement shall not obstruct the driver's normal vision.
 - (ii) When trucks are designed and constructed with larger than normal seating capacity in the front seat, the total number of passengers may be increased provided that the operator's vision and control functions, as required in (15)(g)(i), are maintained.
 - (h) All enclosed crew trucks shall have an emergency exit in addition to the regular entrance.
 - (i) Trucks used for hauling gravel shall not be used as crew trucks unless they are equipped as follows:
 - (i) Steps in proper place or places.

WAC 296-24-233 (Cont.)

- (ii) Wooden floors.
- (iii) Seats are securely fastened.
- (iv) Truck is properly covered.
- (v) All other general regulations covering crew trucks are fully conformed with.
- (j) Half-ton vehicles shall haul not more than six persons including driver. Three-quarter-ton vehicles shall haul not more than eight persons including driver.
- (k) All vehicles carrying crews shall be equipped with stretchers and fire extinguishers.
- (l) No heating units in which there are open fires shall be used in vehicles transporting crews.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-20-079 (Order 04-13, § 296-24-233, filed 10/05/04, effective 02/01/05. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-233, filed 7/20/94, effective 9/20/94; Order 76-29, § 296-24-233, filed 9/30/76; Order 76-6, § 296-24-233, filed 3/1/76; Order 75-11, § 296-24-233, filed 4/4/75; Order 74-27, § 296-24-233, filed 5/7/74; Order 73-5, § 296-24-233, filed 5/9/73 and Order 73-4, § 296-24-233, filed 5/7/73.]

WAC 296-24-235 Overhead and gantry cranes.

[Order 73-5, § 296-24-235, filed 5/9/73 and Order 73-4, § 296-24-235, filed 5/7/73.]

WAC 296-24-23501 Definitions.

- (1) A **“crane”** is a machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism and integral part of the machine. Cranes whether fixed or mobile are driven manually or by power.
- (2) An **“automatic crane”** is a crane which when activated operates through a preset cycle or cycles.
- (3) A **“cab-operated crane”** is a crane controlled by an operator in a cab located on the bridge or trolley.
- (4) **“Cantilever gantry crane”** means a gantry or semigantry crane in which the bridge girders or trusses extend transversely beyond the crane runway on one or both sides.
- (5) **“Floor-operated crane”** means a crane which is pendant or nonconductive rope controlled by an operator on the floor or an independent platform.
- (6) **“Gantry crane”** means a crane similar to an overhead crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway.
- (7) **“Hot metal handling crane”** means an overhead crane used for transporting or pouring molten material.
- (8) **“Overhead crane”** means a crane with a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.
- (9) **“Power-operated crane”** means a crane whose mechanism is driven by electric, air, hydraulic, or internal combustion means.
- (10) A **“pulpit-operated crane”** is a crane operated from a fixed operator station not attached to the crane.

WAC 296-24-23501 (Cont.)

- (11) A **“remote-operated crane”** is a crane controlled by an operator not in a pulpit or in the cab attached to the crane, by any method other than pendant or rope control.
- (12) A **“semigantry crane”** is a gantry crane with one end of the bridge rigidly supported on one or more legs that run on a fixed rail or runway, the other end of the bridge being supported by a truck running on an elevated rail or runway.
- (13) **“Storage bridge crane”** means a gantry type crane of long span usually used for bulk storage of material; the bridge girders or trusses are rigidly or nonrigidly supported on one or more legs. It may have one or more fixed or hinged cantilever ends.
- (14) **“Wall crane”** means a crane having a jib with or without trolley and supported from a side wall or line of columns of a building. It is a traveling type and operates on a runway attached to the side wall or columns.
- (15) **“Appointed”** means assigned specific responsibilities by the employer or the employer's representative.
- (16) **“ANSI”** means the American National Standards Institute.
- (17) An **“auxiliary hoist”** is a supplemental hoisting unit of lighter capacity and usually higher speed than provided for the main hoist.
- (18) A **“brake”** is a device used for retarding or stopping motion by friction or power means.
- (19) A **“drag brake”** is a brake which provides retarding force without external control.
- (20) A **“holding brake”** is a brake that automatically prevents motion when power is off.
- (21) **“Bridge”** means that part of a crane consisting of girders, trucks, end ties, footwalks, and drive mechanism which carries the trolley or trollies.
- (22) **“Bridge travel”** means the crane movement in a direction parallel to the crane runway.
- (23) A **“bumper”** (buffer) is an energy absorbing device for reducing impact when a moving crane or trolley reaches the end of its permitted travel; or when two moving cranes or trolleys come in contact.
- (24) The **“cab”** is the operator's compartment on a crane.
- (25) **“Clearance”** means the distance from any part of the crane to a point of the nearest obstruction.
- (26) **“Collectors”** (current) are contacting devices for collecting current from runway or bridge conductors.
- (27) **“Conductors, bridge”** are the electrical conductors located along the bridge structure of a crane to provide power to the trolley.
- (28) **“Conductors, runway”** (main) are the electrical conductors located along a crane runway to provide power to the crane.
- (29) The **“control braking means”** is a method of controlling crane motor speed when in an overhauling condition.

WAC 296-24-23501 (Cont.)

- (30) **“Countertorque”** means a method of control by which the power to the motor is reversed to develop torque in the opposite direction.
 - (31) **“Dynamic”** means a method of controlling crane motor speeds when in the overhauling condition to provide a retarding force.
 - (32) **“Regenerative”** means a form of dynamic braking in which the electrical energy generated is fed back into the power system.
 - (33) **“Mechanical”** means a method of control by friction.
 - (34) **“Controller, spring return”** means a controller which when released will return automatically to a neutral position.
 - (35) **“Designated”** means selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.
 - (36) A **“drift point”** means a point on a travel motion controller which releases the brake while the motor is not energized. This allows for coasting before the brake is set.
 - (37) The **“drum”** is the cylindrical member around which the ropes are wound for raising or lowering the load.
 - (38) An **“equalizer”** is a device which compensates for unequal length or stretch of a rope.
 - (39) **“Exposed”** means capable of being contacted inadvertently. Applied to hazardous objects not adequately guarded or isolated.
 - (40) **“Fail-safe”** means a provision designed to automatically stop or safely control any motion in which a malfunction occurs.
 - (41) **“Footwalk”** means the walkway with handrail, attached to the bridge or trolley for access purposes.
 - (42) A **“hoist”** is an apparatus which may be a part of a crane, exerting a force for lifting or lowering.
 - (43) **“Hoist chain”** means the load bearing chain in a hoist.
- Note: Chain properties do not conform to those shown in ANSI B30.9-1971, Safety Code for Slings.*
- (44) **“Hoist motion”** means that motion of a crane which raises and lowers a load.
 - (45) **“Load”** means the total superimposed weight on the load block or hook.
 - (46) The **“load block”** is the assembly of hook or shackle, swivel, bearing, sheaves, pins, and frame suspended by the hoisting rope.
 - (47) **“Magnet”** means an electromagnetic device carried on a crane hook to pick up loads magnetically.
 - (48) **“Main hoist”** means the hoist mechanism provided for lifting the maximum rated load.
 - (49) A **“man trolley”** is a trolley having an operator's cab attached thereto.

WAC 296-24-23501 (Cont.)

- (50) **“Rated load”** means the maximum load for which a crane or individual hoist is designed and built by the manufacturer and shown on the equipment nameplate(s).
- (51) **“Rope”** refers to wire rope, unless otherwise specified.
- (52) **“Running sheave”** means a sheave which rotates as the load block is raised or lowered.
- (53) **“Runway”** means an assembly of rails, beams, girders, brackets, and framework on which the crane or trolley travels.
- (54) **“Side pull”** means that portion of the hoist pull acting horizontally when the hoist lines are not operated vertically.
- (55) **“Span”** means the horizontal distance center to center of runway rails.
- (56) **“Standby crane”** means a crane which is not in regular service but which is used occasionally or intermittently as required.
- (57) A **“stop”** is a device to limit travel of a trolley or crane bridge. This device normally is attached to a fixed structure and normally does not have energy absorbing ability.
- (58) A **“switch”** is a device for making, breaking, or for changing the connections in an electric circuit.
- (59) An **“emergency stop switch”** is a manually or automatically operated electric switch to cut off electric power independently of the regular operating controls.
- (60) A **“limit switch”** is a switch which is operated by some part or motion of a power-driven machine or equipment to alter the electric circuit associated with the machine or equipment.
- (61) A **“main switch”** is a switch controlling the entire power supply to the crane.
- (62) A **“master switch”** is a switch which dominates the operation of contractors, relays, or other remotely operated devices.
- (63) The **“trolley”** is the unit which travels on the bridge rails and carries the hoisting mechanism.
- (64) **“Trolley travel”** means the trolley movement at right angles to the crane runway.
- (65) **“Truck”** means the unit consisting of a frame, wheels, bearings, and axles which supports the bridge girders or trolleys.

[Order 73-5, § 296-24-23501, filed 5/9/73 and Order 73-4, § 296-24-23501, filed 5/7/73.]

WAC 296-24-23503 General requirements.

- (1) Application. This section applies to overhead and gantry cranes, including semigantry, cantilever gantry, wall cranes, storage bridge cranes, and others having the same fundamental characteristics. These cranes are grouped because they all have trolleys and similar travel characteristics.
- (2) New and existing equipment. All new overhead and gantry cranes constructed and installed on or after the effective date of these standards, shall meet the design specifications of the American National Standards Institute, Safety Code for Overhead and Gantry Cranes, ANSI B30.2.0-1967. Overhead and gantry cranes constructed before the effective date of these standards, should be modified to conform to those design specifications, unless it can be shown that the crane cannot feasibly or economically be altered and that the crane substantially complies with the requirements of this section. (See WAC 296-350-700 variance from WISHA rules.)

WAC 296-24-23503 (Cont.)

- (3) Modifications. Cranes may be modified and rerated provided such modifications and the supporting structure are checked thoroughly for the new rated load by a qualified engineer or the equipment manufacturer. The crane shall be tested in accordance with WAC 296-24-23521(2). New rated load shall be displayed in accordance with (5) of this section.
- (4) Wind indicators and rail clamps.
 - (a) Outdoor storage bridges shall be provided with automatic rail clamps. A wind-indicating device shall be provided which will give a visible or audible alarm to the bridge operator at a predetermined wind velocity. If the clamps act on the rail heads, any beads or weld flash on the rail heads shall be ground off.
 - (b) Calculations for wind pressure on outside overhead traveling cranes shall be based on not less than 30 pounds per square foot of exposed surface.
- (5) Rated load marking. The rated load of the crane shall be plainly marked on each side of the crane, and if the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block and this marking shall be clearly legible from the ground or floor.
- (6) Clearance from obstruction.
 - (a) Minimum clearance of 3 inches overhead and 2 inches laterally shall be provided and maintained between crane and obstructions in conformity with Specification No. 61 Crane Manufacturers Association of America, Inc., 8720 Red Oak Blvd., Suite 201, Charlotte, NC 28217.
 - (b) Where passageways or walkways are provided obstructions shall not be placed so that safety of personnel will be jeopardized by movements of the crane.
- (7) Clearance between parallel cranes. If the runways of two cranes are parallel, and there are no intervening walls or structure, there shall be adequate clearance provided and maintained between the two bridges.
- (8) Designated personnel. Only designated personnel shall be permitted to operate a crane covered by this section.

[Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-24-23503, filed 05/09/01, effective 09/01/01. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-23503, filed 7/20/94, effective 9/20/94; Order 74-27, § 296-24-23503, filed 5/7/74; Order 73-5, § 296-24-23503, filed 5/9/73 and Order 73-4, § 296-24-23503, filed 5/7/73.]

WAC 296-24-23505 Cabs.

- (1) Cab location.
 - (a) The general arrangement of the cab and the location of control and protective equipment shall be such that all operating handles are within convenient reach of the operator when facing the area to be served by the load hook, or while facing the direction of travel of the cab. The arrangement shall allow the operator a full view of the load hook in all positions.
 - (b) The cab shall be located to afford a minimum of 3 inches clearance from all fixed structures within its area of possible movement.
 - (c) The clearance of the cab above the working floor or passageway should be not less than seven feet.
- (2) Access to crane. Access to the cab and/or bridge walkway shall be by a conveniently placed fixed ladder, stairs, or platform, requiring no step over any gap exceeding 12 inches. Fixed ladders shall be in conformance with the American National Standards Institute, Safety Code for Fixed Ladders, ANSI A14.3-1956.

WAC 296-24-23505 (Cont.)

- (3) Fire extinguisher. A carbon dioxide, dry-chemical, or equivalent hand fire extinguisher should be kept in the cab. Carbon tetrachloride extinguishers shall not be used.

Note: For additional requirements relating to portable fire extinguishers see WAC 296-800-300.

- (4) Lighting. Light in the cab shall be sufficient to enable the operator to see clearly enough to perform the work. [Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-23505, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-23505, filed 5/9/73 and Order 73-4, § 296-24-23505, filed 5/7/73.]

WAC 296-24-23507 Footwalks and ladders.

- (1) Location of footwalks.
- (a) If sufficient headroom is available on cab-operated cranes, a footwalk shall be provided on the drive side along the entire length of the bridge of all cranes having the trolley running on the top of the girders. To give sufficient access to the opposite side of the trolley, there should be provided either a footwalk mounted on the trolley, a suitable footwalk or platform in the building, or a footwalk on the opposite side of the crane at least twice the length of the trolley.
 - (b) Footwalks should be located to give a headroom not less than 78 inches. In no case shall less than 48 inches be provided. If 48 inches of headroom cannot be provided, footwalks should be omitted from the crane and a stationary platform or landing stage built for workers making repairs.
- (2) Construction of footwalks.
- (a) Footwalks shall be of rigid construction and designed to sustain a distributed load of at least 50 pounds per square foot.
 - (b) Footwalks shall have a walking surface of antislip type.
- Note: Wood will meet this requirement.*
- (c) Footwalks should be continuous and permanently secured.
 - (d) Footwalks should have a clear passageway at least 18 inches wide except opposite the bridge motor, where they should be not less than 15 inches. The inner edge shall extend at least to the line of the outside edge of the lower cover plate or flange of the girder.
- (3) Toeboards and handrails for footwalks. Toeboards and handrails shall be in compliance with WAC 296-24-750 through 296-24-75011 and WAC 296-800-260.
- (4) Ladders and stairways.
- (a) Gantry cranes shall be provided with ladders or stairways extending from the ground to the footwalk or cab platform.
 - (b) Stairways shall be equipped with rigid and substantial metal handrails. Walking surfaces shall be of an antislip type.
 - (c) Ladders shall be permanently and securely fastened in place and shall be constructed in compliance with WAC 296-24-810 through 296-24-81011.

[Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-24-23507, filed 05/09/01, effective 09/01/01. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-23507, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-23507, filed 5/9/73 and Order 73-4, § 296-24-23507, filed 5/7/73.]

WAC 296-24-23509 Stops, bumpers, rail sweeps, and guards.

- (1) Trolley stops.
 - (a) Stops shall be provided at the limits of travel of the trolley.
 - (b) Stops shall be fastened to resist forces applied when contacted.
 - (c) A stop engaging the tread of the wheel shall be of a height at least equal to the radius of the wheel.
- (2) Bridge bumpers.
 - (a) A crane shall be provided with bumpers or other automatic means providing equivalent effect, unless the crane travels at a slow rate of speed and has a faster deceleration rate due to the use of sleeve bearings, or is not operated near the ends of bridge and trolley travel, or is restricted to a limited distance by the nature of the crane operation and there is no hazard of striking any object in this limited distance or is used in similar operating conditions. The bumpers shall be capable of stopping the crane (not including the lifted load) at an average rate of deceleration not to exceed 3 ft/s/s when traveling in either direction at 20 percent of the rated load speed.
 - (i) The bumpers shall have sufficient energy absorbing capacity to stop the crane when traveling at a speed of at least 40 percent of rated load speed.
 - (ii) The bumpers shall be so mounted that there is no direct shear on bolts.
 - (iii) Bumpers shall be so designed and installed as to minimize parts falling from the crane in case of breakage.
- (3) Trolley bumpers.
 - (a) A trolley shall be provided with bumpers or other automatic means of equivalent effect, unless the trolley travels at a slow rate of speed, or is not operated near the ends of bridge and trolley travel, or is restricted to a limited distance of the runway and there is no hazard of striking any object in this limited distance, or is used in similar operating conditions. The bumpers shall be capable of stopping the trolley (not including the lifted load) at an average rate of deceleration not to exceed 4.7 ft./s/s when traveling in either direction at one-third of the rated load speed.
 - (i) When more than one trolley is operated on the same bridge, each shall be equipped with bumpers or equivalent on their adjacent ends.
 - (b) Bumpers or equivalent shall be designed and installed to minimize parts falling from the trolley in case of age.
- (4) Rail sweeps. Bridge trucks shall be equipped with sweeps which extend below the top of the rail and project in front of the truck wheels.
- (5) Guards for hoisting ropes.
 - (a) If hoisting ropes run near enough to other parts to make fouling or chafing possible, guards shall be installed to prevent this condition.
 - (b) A guard shall be provided to prevent contact between bridge conductors and hoisting ropes if they could come into contact.

WAC 296-24-23509 (Cont.)

- (6) Guards for moving parts.
 - (a) Exposed moving parts such as gears, set screws, projecting keys, chains, chain sprockets, and reciprocating components which might constitute a hazard under normal operating conditions shall be guarded.
 - (b) Guards shall be securely fastened.
 - (c) Each guard shall be capable of supporting without permanent distortion the weight of a 200-pound person unless the guard is located where it is impossible for a person to step on it.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-17-015 (Order 80-21), § 296-24-23509, filed 11/13/80; Order 74-27, § 296-24-23509, filed 5/7/74; Order 73-5, § 296-24-23509, filed 5/9/73 and Order 73-4, § 296-24-23509, filed 5/7/73.]

WAC 296-24-23511 Brakes.

- (1) Brakes for hoists.
 - (a) Each independent hoisting unit of a crane shall be equipped with at least one self-setting brake, hereafter referred to as a holding brake, applied directly to the motor shaft or some part of the gear train.
 - (b) Each independent hoisting unit of a crane, except worm-gear hoists, the angle of whose worm is such as to prevent the load from accelerating in the lowering direction shall, in addition to a holding brake, be equipped with control braking means to prevent overspeeding.
- (2) Holding brakes.
 - (a) Holding brakes for hoist motors shall have not less than the following percentage of the full load hoisting torque at the point where the brake is applied.
 - (i) 125 percent when used with a control braking means other than mechanical.
 - (ii) 100 percent when used in conjunction with a mechanical control braking means.
 - (iii) 100 percent each if two holding brakes are provided.
 - (b) Holding brakes on hoists shall have ample thermal capacity for the frequency of operation required by the service.
 - (c) Holding brakes on hoists shall be applied automatically when power is removed.
 - (d) Where necessary holding brakes shall be provided with adjustment means to compensate for wear.
 - (e) The wearing surface of all holding-brake drums or discs shall be smooth.
 - (f) Each independent hoisting unit of a crane handling hot metal and having power control braking means shall be equipped with at least two holding brakes.

WAC 296-24-23511 (Cont.)

- (3) Control braking means.
 - (a) A power control braking means such as regenerative, dynamic or countertorque braking, or a mechanically controlled braking means shall be capable of maintaining safe lowering speeds of rated loads.
 - (b) The control braking means shall have ample thermal capacity for the frequency of operation required by service.
- (4) Brakes for trolleys and bridges.
 - (a) Foot operated brakes shall not require an applied force of more than 70 pounds to develop manufacturer's rated brake torque.
 - (b) Brakes may be applied by mechanical, electrical, pneumatic, hydraulic, or gravity means.
 - (c) Where necessary brakes shall be provided with adjustment means to compensate for wear.
 - (d) The wearing surface of all brake drums or discs shall be smooth.
 - (e) All foot-brake pedals shall be constructed so that the operator's foot will not easily slip off the pedal.
 - (f) Foot-operated brakes shall be equipped with automatic means for positive release when pressure is released from the pedal.
 - (g) Brakes for stopping the motion of the trolley or bridge shall be of sufficient size to stop the trolley or bridge within a distance in feet equal to 10 percent of full load speed in feet per minute when traveling at full speed with full load.
 - (h) If holding brakes are provided on the bridge or trolley(s), they shall not prohibit the use of a drift point in the control circuit.
 - (i) Brakes on trolleys and bridges shall have ample thermal capacity for the frequency of operation required by the service to prevent impairment of functions from overheating.
- (5) Application of trolley brakes.
 - (a) On cab-operated cranes with cab on trolley, a trolley brake shall be required as specified under (4) of this section.
 - (b) A drag brake may be applied to hold the trolley in a desired position on the bridge and to eliminate creep with the power off.
- (6) Application of bridge brakes.
 - (a) On cab-operated cranes with cab on bridge, a bridge brake is required as specified under (4) of this section.
 - (b) On cab-operated cranes with cab on trolley, a bridge brake of the holding type shall be required.

WAC 296-24-23511 (Cont.)

- (c) On all floor, remote and pulpit-operated crane bridge drives, a brake or noncoasting mechanical drive shall be provided.

[Order 73-5, § 296-24-23511, filed 5/9/73 and Order 73-4, § 296-24-23511, filed 5/7/73.]

WAC 296-24-23513 Electric equipment.

(1) General.

- (a) Wiring and equipment shall comply with chapter 296-24 WAC Part L, and WAC 296-800-280.
- (b) The control circuit voltage shall not exceed 600 volts for a.c. or d.c. current.
- (c) The voltage at pendant pushbuttons shall not exceed 150 volts for a.c. and 300 volts for d.c.
- (d) Where multiple conductor cable is used with a suspended pushbutton station, the station shall be supported in a manner that will protect the electrical conductors against strain.
- (e) Pendant control boxes shall be constructed to prevent electrical shock and shall be clearly marked for identification of functions.

(2) Equipment.

- (a) Electrical equipment shall be so located or enclosed that live parts will not be exposed to accidental contact under normal operating conditions.
- (b) Electric equipment shall be protected from dirt, grease, oil, and moisture.
- (c) Guards for live parts shall be substantial and so located that they cannot be accidentally deformed so as to make contact with the live parts.

(3) Controllers.

- (a) Cranes not equipped with spring-return controllers or momentary contact pushbuttons shall be provided with a device which will disconnect all motors from the line on failure of power and will not permit any motor to be restarted until the controller handle is brought to the "off" position, or a reset switch or button is operated.
- (b) Lever operated controllers shall be provided with a notch or latch which in the "off" position prevents the handle from being inadvertently moved to the "on" position. An "off" detent or spring return arrangement is acceptable.
- (c) The controller operating handle shall be located within convenient reach of the operator.
- (d) As far as practicable, the movement of each controller handle shall be in the same general directions as the resultant movements of the load.
- (e) The control for the bridge and trolley travel shall be so located that the operator can readily face the direction of travel.
- (f) For floor-operated cranes, the controller or controllers if rope operated, shall automatically return to the "off" position when released by the operator.

WAC 296-24-23513 (Cont.)

- (g) Pushbuttons in pendant stations shall return to the off position when pressure is released by the crane operator.
 - (h) Automatic cranes shall be so designed that all motions shall fail-safe if any malfunction of operation occurs.
 - (i) Remote-operated cranes shall function so that if the control signal for any crane motion becomes ineffective the crane motion shall stop.
- (4) Resistors.
 - (a) Enclosures for resistors shall have openings to provide adequate ventilation, and shall be installed to prevent the accumulation of combustible matter near hot parts.
 - (b) Resistor units shall be supported so as to be free as possible from vibration.
 - (c) Provision shall be made to prevent broken parts or molten metal falling upon the operator or from the crane.
- (5) Switches.
 - (a) The power supply to the runway conductors shall be controlled by a switch or circuit breaker located on a fixed structure, accessible from the floor, and arranged to be locked in the open position.
 - (b) On cab-operated cranes a switch or circuit breaker of the enclosed type, with provision for locking in the open position shall be provided in the leads from the runway conductors. A means of opening this switch or circuit breaker shall be located within easy reach of the operator.
 - (c) On floor-operated cranes, a switch or circuit breaker of the enclosed type, with provision for locking in the open position, shall be provided in the leads from the runway conductors. This disconnect shall be mounted on the bridge or footwalk near the runway collectors. One of the following types of floor operated disconnects shall be provided:
 - (i) Nonconductive rope attached to the main disconnect switch.
 - (ii) An undervoltage trip for the main circuit breaker operated by an emergency stop button in the pendant pushbutton station.
 - (iii) A main line contactor operated by a switch or pushbutton in the pendant pushbutton station.
 - (d) The hoisting motion of all electric traveling cranes shall be provided with an overtravel limit switch in the hoisting direction.
 - (e) All cranes using a lifting magnet shall have a magnet circuit switch of the enclosed type with provision for locking in the open position. Means for discharging the inductive load of the magnet shall be provided.

WAC 296-24-23513 (Cont.)

- (6) Runway conductors. Conductors of the open type mounted on the crane runway beams or overhead shall be so located or so guarded that persons entering or leaving the cab or crane footwalk normally could not come into contact with them.
- (7) Extension lamps. If a service receptacle is provided in the cab or on the bridge of cab-operated cranes, it shall be a grounded three-prong type permanent receptacle, not exceeding 300 volts.
- (8) Floor operated cranes.
 - (a) An unobstructed aisle not less than three feet wide shall be maintained for travel of the operator except in such cases where the control handles are hung from the trolleys of traveling cranes.
 - (b) The handles of control ropes shall be distinctly different in contour so that, without looking, the operator will know which is the hoisting and which is the lowering handle. The direction of all movements of the crane shall be clearly indicated in some manner so that the operator can easily become familiar with them.
 - (c) When repairing runways, repairpersons shall place rail stops and warning signs or signals so as to protect both ends of the section to be repaired.
 - (d) Repairpersons shall take care to prevent loose parts from falling or being thrown upon the floor beneath.

[Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-24-23513, filed 05/09/01, effective 09/01/01. Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-23513, filed 11/22/91, effective 12/24/91; Order 73-5, § 296-24-23513, filed 5/9/73 and Order 73-4, § 296-24-23513, filed 5/7/73.]

WAC 296-24-23515 Hoisting equipment.

- (1) Sheaves.
 - (a) Sheave grooves shall be smooth and free from surface defects which could cause rope damage.
 - (b) Sheaves carrying ropes which can be momentarily unloaded shall be provided with close-fitting guards or other suitable devices to guide the rope back into the groove when the load is applied again.
 - (c) The sheaves in the bottom block shall be equipped with close-fitting guards that will prevent ropes from becoming fouled when the block is laying on the ground with ropes loose.
 - (d) Pockets and flanges of sheaves used with hoist chains shall be of such dimensions that the chain does not catch or bind during operation.
 - (e) All running sheaves shall be equipped with means for lubrication. Permanently lubricated, sealed and/or shielded bearings meet this requirement.
- (2) Ropes.
 - (a) In using hoisting ropes, the crane manufacturer's recommendation shall be followed. The rated load divided by the number of parts of rope shall not exceed 20 percent of the nominal breaking strength of the rope.

WAC 296-24-23515 (Cont.)

- (b) Socketing shall be done in the manner specified by the manufacturer of the assembly.
- (c) Rope shall be secured to the drum as follows:
 - (i) No less than two wraps of rope shall remain on the drum when the hook is in its extreme low position.
 - (ii) Rope end shall be anchored by a clamp securely attached to the drum, or by a socket arrangement approved by the crane or rope manufacturer.
- (d) Rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope. Spacing and number of all types of clips shall be in accordance with (2)(e) of this section. Clips shall be drop-forged steel in all sizes manufactured commercially. When a newly installed rope has been in operation for an hour, all nuts on the clip bolts shall be retightened.

(e)

Diameter of Rope	Number Of Clips Required	Space Between Clips
1 1/2 inch	8	10 inches
1 3/8 inch	7	9 inches
1 1/4 inch	6	8 inches
1 1/8 inch	5	7 inches
1 inch	5	6 inches
7/8 inch	5	5 1/4 inches
3/4 inch	5	4 1/2 inches
3/8 to 5/8 inch	4	3 inches

- (f) Swaged or compressed fittings shall be applied as recommended by the rope or crane manufacturer.
 - (g) Wherever exposed to temperatures, at which fiber cores would be damaged, rope having an independent wire-rope or wire-strand core, or other temperature-damage resistant core shall be used.
 - (h) Replacement rope shall be the same size, grade, and construction as the original rope furnished by the crane manufacturer, unless otherwise recommended by a wire rope manufacturer due to actual working condition requirements.
- (3) Equalizers. If a load is supported by more than one part of rope, the tension in the parts shall be equalized.
- (4) Hooks. Hooks shall meet the manufacturer's recommendations and shall not be overloaded. Safety latch-type hooks shall be used or the hook shall be moused.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-17-015 (Order 80-21), § 296-24-23515, filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-23515, filed 7/31/79; Order 73-5, § 296-24-23515, filed 5/9/73 and Order 73-4, § 296-24-23515, filed 5/7/73.]

WAC 296-24-23517 Warning device. Except for floor operated cranes a gong or other effective warning signal shall be provided for each crane equipped with a powered traveling mechanism.
[Order 73-5, § 296-24-23517, filed 5/9/73 and Order 73-4, § 296-24-23517, filed 5/7/73.]

WAC 296-24-23519 Inspection.

- (1) Inspection classification.
 - (a) Initial inspection. Prior to initial use all new and altered cranes shall be inspected to insure compliance with the provisions of these standards.
 - (b) Inspection procedure for cranes in regular service is divided into two general classifications based upon the intervals at which inspection should be performed. The intervals in turn are dependent upon the nature of the critical components of the crane and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are herein designated as “frequent” and “periodic” with respective intervals between inspections as defined below:
 - (i) Frequent inspection - daily to monthly intervals.
 - (ii) Periodic inspection - 1 to 12 month intervals.
- (2) Frequent inspection. The following items shall be inspected for defects at intervals as defined in (1)(b) of this section or as specifically indicated, including observation during operation for any defects which might appear between regular inspections. All deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:
 - (a) All functional operating mechanisms for maladjustment interfering with proper operation. Daily.
 - (b) Deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of air or hydraulic systems. Daily.
 - (c) Hooks with deformation or cracks. Visual inspection daily; monthly inspection with signed reports. For hooks with cracks or having more than 15 percent in excess of normal throat opening or more than 10° twist from the plane of the unbent hook refer to WAC 296-24-23523 (3)(c)(i).
 - (d) Hoist or load attachment chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturer's recommendations. Visual inspection daily; monthly inspection with signed report.
 - (e) Rope slings, including end connections, for excessive wear, broken wires, stretch, kinking, or twisting. Visual inspection daily; monthly inspection with signed report.
 - (f) All functional operating mechanisms for excessive wear of components.
 - (g) Rope reeving for noncompliance with manufacturer's recommendations.
- (3) Periodic inspection. Complete inspections of the crane shall be performed at intervals as generally defined in (1)(b)(ii) of this section, depending upon its activity, severity of service, and environment, or as specifically indicated below. These inspections shall include the requirements of (2) of this section and in addition, the following items. Any deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:

WAC 296-24-23519 (Cont.)

- (a) Deformed, cracked, or corroded members.
 - (b) Loose bolts or rivets.
 - (c) Cracked or worn sheaves and drums.
 - (d) Worn, cracked or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices.
 - (e) Excessive wear on brake system parts, linings, pawls, and ratchets.
 - (f) Load, wind, and other indicators over their full range, for any significant inaccuracies.
 - (g) Gasoline, diesel, electric, or other powerplants for improper performance or noncompliance with applicable safety requirements.
 - (h) Excessive wear of chain drive sprockets and excessive chain stretch.
 - (i) Crane hooks. Magnetic particle or other suitable crack detecting inspection should be performed at least once each year.
 - (j) Electrical apparatus, for signs of pitting or any deterioration of controller contactors, limit switches and pushbutton stations.
- (4) Cranes not in regular use.
- (a) A crane which has been idle for a period of 1 month or more, but less than 6 months, shall be given an inspection conforming with requirements of (2) of this section and WAC 296-24-23525(2), before placing in service.
 - (b) A crane which has been idle for a period of over 6 months shall be given a complete inspection conforming with requirements of (2) and (3) of this section and WAC 296-24-23525(2) before placing in service.
 - (c) Standby cranes shall be inspected at least semi-annually in accordance with requirements of (2) of this section and WAC 296-24-23525(2). Standby cranes exposed to adverse environment should be inspected more frequently.

[Order 73-5, § 296-24-23519, filed 5/9/73 and Order 73-4, § 296-24-23519, filed 5/7/73.]

WAC 296-24-23521 Testing.

- (1) Operational tests.
 - (a) Prior to initial use all new and altered cranes shall be tested to insure compliance with this section including the following functions:
 - (i) Hoisting and lowering.
 - (ii) Trolley travel.
 - (iii) Bridge travel.

WAC 296-24-23521 (Cont.)

- (iv) Limit switches, locking and safety devices.
- (b) The trip setting of hoist limit switches shall be determined by tests with an empty hook traveling in increasing speeds up to the maximum speed. The actuating mechanism of the limit switch shall be located so that it will trip the switch, under all conditions, in sufficient time to prevent contact of the hook or hook block with any part of the trolley.
- (2) Rated load test. Prior to initial use all new, extensively repaired, and altered cranes should be tested by or under the direction of an appointed or authorized person, confirming the load rating of the crane. The load rating should not be more than 80 percent of the maximum load sustained during the test. Test loads shall not be more than 125 percent of the rated load unless otherwise recommended by the manufacturer. The tests reports shall be placed on file where readily available to appointed personnel.

[Order 73-5, § 296-24-23521, filed 5/9/73 and Order 73-4, § 296-24-23521, filed 5/7/73.]

WAC 296-24-23523 Maintenance.

- (1) Preventive maintenance. A preventive maintenance program based on the crane manufacturer's recommendations shall be established.
- (2) Maintenance procedure.
 - (a) Before adjustments and repairs are started on a crane the following precautions shall be taken:
 - (i) The crane to be repaired shall be run to a location where it will cause the least interference with other cranes and operations in the area.
 - (ii) All controllers shall be at the off position.
 - (iii) The main or emergency switch shall be open and locked in the open position.
 - (iv) Warning or "out of order" signs shall be placed on the crane, also on the floor beneath or on the hook where visible from the floor.
 - (v) Where other cranes are in operation on the same runway, rail stops or other suitable means shall be provided to prevent interference with the idle crane.
 - (vi) Where temporary protective rail stops are not available, or practical, a signalperson should be placed at a visual vantage point for observing the approach of an active crane and warning its operator when reaching the limit of safe distance from the idle crane.
 - (b) After adjustments and repairs have been made the crane shall not be operated until all guards have been reinstalled, safety devices reactivated and maintenance equipment removed.
- (3) Adjustments and repairs.
 - (a) Any unsafe conditions disclosed by the inspection requirements of WAC 296-24-23519 shall be corrected before operation of the crane is resumed. Adjustments and repairs shall be done only by designated personnel.

WAC 296-24-23523 (Cont.)

- (b) Adjustments shall be maintained to assure correct functioning of components. The following are examples:
 - (i) All functional operating mechanisms.
 - (ii) Limit switches.
 - (iii) Control systems.
 - (iv) Brakes.
 - (v) Power plants.
- (c) Repairs or replacements shall be provided promptly as needed for safe operation. The following are examples:
 - (i) Accessory components, such as hooks, shall be carefully examined periodically and at the time of annual examination and inspection. Cracked or deformed hooks shall be discarded immediately and not reused on any equipment subject to the provisions of this code.
 - (ii) Load attachment chains and rope slings showing defects described in WAC 296-24-23519 (2)(d) and (e) respectively.
 - (iii) All critical parts which are cracked, broken, bent, or excessively worn.
 - (iv) Pendant control stations shall be kept clean and function labels kept legible.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-23523, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-23523, filed 5/9/73 and Order 73-4, § 296-24-23523, filed 5/7/73.]

WAC 296-24-23525 Rope inspection.

- (1) Running ropes. A thorough inspection of all ropes shall be made at least once a month and a full written, dated, and signed report of rope condition kept on file where readily available to appointed personnel. Any deterioration, resulting in appreciable loss of original strength, such as described below, shall be carefully noted and determination made as to whether further use of the rope would constitute a safety hazard:
 - (a) Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.
 - (b) A number of broken outside wires and the degree of distribution or concentration of such broken wires.
 - (c) Worn outside wires.
 - (d) Corroded or broken wires at end connections.
 - (e) Corroded, cracked, bent, worn, or improperly applied end connections.

WAC 296-24-23525 (Cont.)

- (f) Severe kinking, crushing, cutting, or unstranding.
- (2) Other ropes. All rope which has been idle for a period of a month or more due to shutdown or storage of a crane on which it is installed shall be given a thorough inspection before it is placed in service. This inspection shall be for all types of deterioration and shall be performed by an appointed person whose approval shall be required for further use of the rope. A written and dated report of the rope condition shall be available for inspection.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-17-015 (Order 80-21), § 296-24-23525, filed 11/13/80; Order 73-5, § 296-24-23525, filed 5/9/73 and Order 73-4, § 296-24-23525, filed 5/7/73.]

WAC 296-24-23527 Handling the load.

- (1) Size of load. The crane shall not be loaded beyond its rated load except for test purposes as provided in WAC 296-24-23521.
- (2) Attaching the load.
 - (a) The hoist chain or hoist rope shall be free from kinks or twists and shall not be wrapped around the load.
 - (b) The load shall be attached to the load block hook by means of slings or other approved devices.
 - (c) Care shall be taken to make certain that the sling clears all obstacles.
- (3) Moving the load.
 - (a) The load shall be well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches.
 - (b) Before starting to hoist the following conditions shall be noted:
 - (i) Hoist rope shall not be kinked.
 - (ii) Multiple part lines shall not be twisted around each other.
 - (iii) The hook shall be brought over the load in such a manner as to prevent swinging.
 - (c) During hoisting care shall be taken that:
 - (i) There is no sudden acceleration or deceleration of the moving load.
 - (ii) The load does not contact any obstructions.
 - (d) Cranes shall not be used for side pulls except when specifically authorized by a responsible person who has determined that the stability of the crane is not thereby endangered and that various parts of the crane will not be overstressed.
 - (e) While any employee is on the load or hook, there shall be no hoisting, lowering, or traveling.
 - (f) The employer shall require that the operator avoid carrying loads over people.

WAC 296-24-23527 (Cont.)

- (g) The operator shall test the brakes each time a load approaching the rated load is handled. The brakes shall be tested by raising the load a few inches and applying the brakes.
 - (h) The load shall not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.
 - (i) When two or more cranes are used to lift a load one qualified responsible person shall be in charge of the operation. The qualified person shall analyze the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made.
 - (j) The employer shall assure that the operator does not leave the control position while the load is suspended.
 - (k) When starting the bridge and when the load or hook approaches near or over personnel, the warning signal shall be sounded.
- (4) Hoist limit switch.
- (a) At the beginning of each operator's shift, the upper limit switch of each hoist shall be tried out under no load. Extreme care shall be exercised; the block shall be "inched" into the limit or run in at slow speed. If the switch does not operate properly, the appointed person shall be immediately notified.
 - (b) The hoist limit switch which controls the upper limit of travel of the load block shall never be used as an operating control.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-23527, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-23527, filed 5/9/73 and Order 73-4, § 296-24-23527, filed 5/7/73.]

WAC 296-24-23529 Operators.

- (1) Cranes shall be operated only by regular crane operators, authorized substitutes who have had adequate experience and training under the supervision of a competent operator, or by crane repairmen or inspectors.
- (2) Crane operators must be able to communicate with others at the worksite sufficiently to understand the signs, notices, operation instructions, and the signal code in use to ensure safe operation of the crane.
- (3) No minor under eighteen years of age shall be employed in occupations involving the operation of any power-driven hoisting apparatus or assisting in such operations by work such as hooking on, loading slings, rigging gear, etc.
- (4) No person shall be permitted to operate a crane whose hearing or eye-sight is impaired, or who may be suffering from heart disease or similar ailments. The following physical qualifications shall be minimum requirements for overhead and gantry crane operators and trainees:
 - (a) They shall have vision of at least 20/30 in one eye, and 20/50 in the other, with or without corrective lenses.
 - (b) They shall be able to distinguish colors, regardless of position of colors, if color differential is required for operation.
 - (c) Their hearing, with or without hearing aid, must be adequate for a specific operation.
 - (d) They shall have sufficient strength, endurance, agility, coordination, and speed of reaction to meet the demands of equipment operation.

WAC 296-24-23529 (Cont.)

- (e) They shall have normal depth perception, field of vision, reaction time, manual dexterity, coordination and no tendencies to dizziness or similar undesirable characteristics.
 - (f) Evidence of physical defects, or emotional instability which could render the operator or trainee a hazard to their self or others, or could interfere with their safe performance may be sufficient cause for disqualification. In such cases, specialized clinical or medical judgments or tests shall be required (which include annual medical certification for recovered heart attack patients).
 - (g) Evidence that an operator or trainee is subject to seizures or loss of physical control shall be sufficient reason for disqualification. Specialized medical tests shall be required to substantiate these conditions.
- (5) Persons who have recovered from a heart attack shall be exempted from the provisions of subsection (3) of this section, as it pertains to their heart condition, provided:
- (a) A medical release is obtained from their attending medical doctor.
 - (b) The release shall state that the operation of a crane will not present a hazard to their self or others.
 - (c) An examination by a medical doctor, and renewal of the work release certification is required annually.
- (6) The operator shall be fully familiar with all crane rules and with the crane mechanism and its proper care. Needed adjustments or repairs shall be reported at once to the proper authority.
- (7) The operator shall not eat, smoke or read while actually engaged in the operation of the crane, or operate the crane when physically unfit.
- (8) The operator or someone especially designated shall properly lubricate all working parts of the crane.
- (9) Cranes shall be kept clean.
- (10) Whenever the operator finds the main or emergency switch open, it shall not be closed, even when starting on regular duty, until it is determined that no one is on or about the crane. The crane shall not be oiled or repaired unless the main switch is open.
- (11) If the power goes off, the operator shall immediately throw all controllers to "off" position until the power is again available.
- (12) Before closing the main switch the operator shall make sure that all controllers are in "off" position until the power is again available.
- (13) The operator shall recognize signals only from the employee who is supervising the lift. Operating signals shall follow an established standard. Whistle signals may be used where one crane only is in operation.
- (14) Bumping into runway stops or other cranes shall be avoided. When the operator is ordered to engage with or push other cranes, it shall be done with special care for the safety of persons on or below cranes.

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- (15) When lowering a load, the operator shall proceed carefully and make sure the load is under safe control.
- (16) When leaving the cage the operator shall throw all controllers to "off" position and open the main switch.
- (17) If the crane is located out-of-doors the operator shall lock the crane in a secure position to prevent it from being blown along or off the track by a severe wind.
- (18) Operators shall not permit anyone to ride on the load or hooks, unless using a lifeline or safety device approved by the department.

[Statutory Authority: RCW 49.17.010, .040, .050. 99-17-094 (Order 99-01), § 296-24-23529, filed 08/17/99, effective 12/01/99. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-23529, filed 7/20/94, effective 9/20/94. 89-11-035 (Order 89-03), § 296-24-23529, filed 5/15/89, effective 6/30/89; Order 73-5, § 296-24-23529, filed 5/9/73 and Order 73-4, § 296-24-23529, filed 5/7/73.]

WAC 296-24-23531 Other requirements-General.

- (1) Ladders.
 - (a) The employer shall insure that hands are free from encumbrances while personnel are using ladders.
 - (b) Articles which are too large to be carried in pockets or belts shall be lifted and lowered by hand line.
- (2) Cabs.
 - (a) Necessary clothing and personal belongings shall be stored in such a manner as not to interfere with access or operation.
 - (b) Tools, oil cans, waste, extra fuses, and other necessary articles shall be stored in the tool box, and shall not be permitted to lie loose in or about the cab.
- (3) Fire extinguishers. The employer shall insure that operators are familiar with the operation and care of fire extinguishers provided.

[Order 73-5, § 296-24-23531, filed 5/9/73 and Order 73-4, § 296-24-23531, filed 5/7/73.]

WAC 296-24-23533 Crane and derrick suspended personnel (work) platforms.

- (1) Scope and application. This standard applies to the design, construction, testing, use and maintenance of personnel platforms, and the hoisting of personnel platforms on the load lines of cranes or derricks.
- (2) Definitions. For the purposes of this section, the following definitions apply:
 - (a) **"Failure"** means load refusal, breakage, or separation of components.
 - (b) **"Hoist"** (or hoisting) means all crane or derrick functions such as lowering, lifting, swinging, booming in and out or up and down, or suspending a personnel platform.

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- (c) **“Load refusal”** means the point where the ultimate strength is exceeded.
 - (d) **“Maximum intended load”** means the total load of all employees tools, materials, and other loads reasonably anticipated to be applied to a personnel platform or personnel platform component at any one time.
 - (e) **“Runway”** means a firm, level surface designed, prepared, and designated as a path of travel for the weight and configuration of the crane being used to lift and travel with the crane suspended platform. An existing surface may be used as long as it meets these criteria.
- (3) General requirements. The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous, or is not possible because of structural design or worksite conditions.
- (4) Operational criteria.
- (a) Hoisting of the personnel platform shall be performed in a slow, controlled, cautious manner with no sudden movements of the crane or derrick, or the platform.
 - (b) Load lines shall be capable of supporting, without failure, at least seven times the maximum intended load, except that where rotation resistant rope is used, the lines shall be capable of supporting without failure, at least ten times the maximum intended load. The required design factor is achieved by taking the current safety factor of 3.5 and applying the fifty percent derating of the crane capacity.
 - (c) Load and boom hoist drum brakes, swing brakes, and locking devices such as pawls or dogs shall be engaged when the occupied personnel platform is in a stationary working position.
 - (d) Cranes and derricks with variable angle booms shall be equipped with a boom angle indicator, readily visible to the operator.
 - (e) Cranes with telescoping booms shall be equipped with a device to indicate clearly to the operator, at all times, the boom's extended length, or an accurate determination of the load radius to be used during the lift shall be made prior to hoisting personnel.
 - (f) A positive acting device shall be used which prevents contact between the load block or overhaul ball and the boom tip (anti-two-blocking device), or a system shall be used which deactivates the hoisting action before damage occurs in the event of a two-blocking situation (two block damage prevention feature).
 - (g) The load line hoist drum shall have a system or device on the power train, other than the load hoist brake, which regulates the lowering rate of speed of the hoist mechanism (controlled load lowering). Free fall is prohibited.
 - (h) The crane shall be uniformly level within one percent of level grade and located on firm footing. Cranes equipped with outriggers shall have them all fully deployed following manufacturer's specifications, insofar as applicable, when hoisting employees.
 - (i) The total weight of the loaded personnel platform and related rigging shall not exceed fifty percent of the rated capacity for the radius and configuration of the crane or derrick.

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- (j) The use of machines having live booms (booms in which lowering is controlled by a brake without aid from other devices which slow the lowering speeds) is prohibited.
 - (k) Multiple-part line block: When a multiple-part line block is in use, a substantial strap shall be used between the crane hook and common ring, shackle, or other equivalent device, to eliminate employee exposure to the lines running through the block, and to the block itself.
- (5) Rigging.
- (a) Lifting bridles on box-type platforms shall consist of four legs of equal length, with one end securely shackled to each corner of the platform and the other end securely attached to a common ring, shackle, or other equivalent device to accommodate the crane hook, or a strap to the crane hook.
 - (b) Shackle bolts used for rigging of personnel platforms shall be secured against displacement.
 - (c) A substantial safety line shall pass through the eye of each leg of the bridle adjacent to the common ring, shackle, or equivalent device and be securely fastened with a minimum amount of slack to the lift line above the headache ball or to the crane hook itself.
 - (d) All eyes in wire rope sling shall be fabricated with thimbles.
 - (e) Wire rope, shackles, rings, master links, and other rigging hardware must be capable of supporting, without failure, at least five times the maximum intended load applied or transmitted to that component. Where rotation resistant wire rope is used for slings, they shall be capable of supporting without failure at least ten times the maximum intended load.
 - (f) Hooks on headache ball assemblies, lower load blocks, or other attachment assemblies shall be of a type that can be closed and locked, eliminating the hook throat opening. Alternatively, an alloy anchor type shackle with a bolt, nut, and retaining pin shall be used.
 - (g) Bridles and associated rigging for attaching the personnel platform to the hoist line shall be used only for the platform and the necessary employees, their tools and the materials necessary to do their work, and shall not be used for any other purpose when not hoisting personnel.
- (6) Personnel platforms - design criteria.
- (a) The personnel platform and suspension system shall be designed by a qualified engineer or a qualified person competent in structural design.
 - (b) The suspension system shall be designed to minimize tipping of the platform due to movement of employees occupying the platform.
 - (c) The personnel platform itself, except the guardrail system and body belt/harness anchorages, shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load based on a minimum allowance of five hundred pounds for the first person with light tools, and an additional two hundred fifty pounds for each additional person.
 - (d) Criteria for guardrail systems and body belt/harness anchorages are contained in Parts J-1 and J-2 of this chapter.

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- (e) The personnel platform shall be conspicuously posted with a plate or other permanent marking which indicates the weight of the platform and its rated load capacity or maximum intended load.
- (7) Platform specifications.
 - (a) Each personnel platform shall be equipped with a guardrail system which meets the requirements of WAC 296-24-75007, and shall be enclosed at least from the toeboard to mid-rail with either solid construction or expanded metal having openings no greater than one-half inch (1.27cm).
 - (b) A grab rail shall be installed inside the entire perimeter of the personnel platform.
 - (c) Access gates, if installed, shall not swing outward during hoisting.
 - (d) Access gates, including sliding or folding gates, shall be equipped with a restraining device to prevent accidental opening.
 - (e) Headroom shall be provided which allows employees to stand upright in the platform.
 - (f) In addition to the use of hard hats, employees shall be protected by overhead protection on the personnel platform when employees are exposed to falling objects.
 - (g) All rough edges exposed to contact by employees shall be surfaced or smoothed in order to prevent injury to employees from punctures or lacerations.
 - (h) All welding of the personnel platform and its components shall be performed by a qualified welder familiar with the weld grades, types, and material specified in the platform design.
 - (i) Occupants of all personnel platforms shall wear a safety belt or harness and lanyard which meets the requirements of ANSI A10.14- 1975.
 - (j) Box-type platform: The workers lanyard shall be secured to the work platform or guardrail of the work platform.
 - (k) Rescue platform:
 - (i) If the platform is used as a rescue vehicle, the injured worker shall be strapped into the stretcher or basket.
 - (ii) The basket shall then be secured by lanyard to an anchorage within the platform.
 - (l) Boatswains chair: The workers lanyard shall be secured to the lift line above the headache ball or to the crane hook itself.
 - (m) Barrel-type platform:
 - (i) The workers lanyard shall be secured to the lift line above the headache ball or to the crane hook itself.
 - (ii) A solid bar or rod shall be substantially attached in a rigid position to the bottom or side of the platform.

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- (iii) The side bar or rod shall extend a minimum of eight feet above the floor of the work platform.
 - (iv) The bottom of the barrel-type platform shall be of a convex shape to cause the platform to lay on its side when lowered to the ground or floor.
 - (v) Workers shall enter and exit from barrel-type platforms only when they are in an upright position, stable, and securely attached to the load line.
 - (vi) The employer shall use methods or devices which allow employees to safely enter or exit barrel-type platforms.
- (8) Personnel platform loading.
 - (a) The personnel platform shall not be loaded in excess of its rated load capacity.
 - (b) The number of employees occupying the personnel platform shall not exceed the number required for the work being performed.
 - (c) Personnel platforms shall be used only for employees, their tools, and the materials necessary to do their work, and shall not be used to hoist only materials or tools when not hoisting personnel.
 - (d) Materials and tools for use during a personnel lift shall be secured to prevent displacement.
 - (e) Materials and tools for use during a personnel lift shall be evenly distributed within the confines of the platform while the platform is suspended.
- (9) Trial lift, inspection, and prooftesting.
 - (a) A trial lift with the unoccupied personnel platform loaded at least to the anticipated liftweight shall be made from ground level, or any other location where employees will enter the platform, to each location at which the personnel platform is to be hoisted and positioned. This trial lift shall be performed immediately prior to placing personnel on the platform. The operator shall determine that all systems, controls, and safety devices are activated and functioning properly; that no interferences exist; and that all configurations necessary to reach those work locations will allow the operator to remain under the fifty percent limit of the hoist's rated capacity. Materials and tools to be used during the actual lift can be loaded in the platform, as provided in subsection (8)(d) and (e) of this section for the trial lift. A single trial lift may be performed at one time for all locations that are to be reached from a single set-up position.
 - (b) The trial lift shall be repeated prior to hoisting employees whenever the crane or derrick is moved and set up in a new location or returned to a previously used location. Additionally, the trial lift shall be repeated when the lift route is changed unless the operator determines that the route change is not significant (i.e., the route change would not affect the safety of hoisted employees).
 - (c) After the trial lift, and just prior to hoisting personnel, the platform shall be hoisted a few inches and inspected to ensure that it is secure and properly balanced. Employees shall not be hoisted unless the following conditions are determined to exist:

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- (i) Hoist ropes shall be free of kinks;
 - (ii) Multiple part lines shall not be twisted around each other;
 - (iii) The primary attachment shall be centered over the platform; and
 - (iv) The hoisting system shall be inspected if the load rope is slack to ensure all ropes are properly stated on drums and in sheaves.
 - (d) A visual inspection of the crane or derrick, rigging, personnel platform, and the crane or derrick base support or ground shall be conducted by a competent person immediately after the trial lift to determine whether the testing has exposed any defect or produced any adverse effect upon any component or structure.
 - (e) Any defects found during inspections which create a safety hazard shall be corrected before hoisting personnel.
 - (f) At each job site, prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging shall be prooftested to one hundred twenty-five percent of the platform's rated capacity by holding it in a suspended position for five minutes with the test load evenly distributed on the platform (this may be done concurrently with the trial lift). After prooftesting, a competent person shall inspect the platform and rigging. Any deficiencies found shall be corrected and another prooftest shall be conducted. Personnel hoisting shall not be conducted until the prooftesting requirements are satisfied.
 - (g) The employer shall retain at the jobsite and produce when requested, documentation such as lift capacity information, verifying that the requirements of this standard have been met.
- (10) Work practices.
- (a) Employees shall keep all parts of the body inside the platform during raising, lowering, and positioning. This provision does not apply to an occupant of the platform performing the duties of a signal person.
 - (b) Before employees exit or enter a hoisted personnel platform that is not landed, the platform shall be secured to the structure where the work is to be performed, unless securing to the structure creates an unsafe situation.
 - (c) Tag lines shall be used unless their use creates an unsafe condition.
 - (d) The crane or derrick operator shall remain at the controls at all times when the crane engine is running and the platform is occupied.
 - (e) Hoisting of employees shall be promptly discontinued upon indication of any dangerous weather conditions or other impending danger.
 - (f) Employees being hoisted shall remain in continuous sight of and in direct communication with the operator or signal person. In those situations where direct visual contact with the operator is not possible, and the use of a signal person would create a greater hazard for that person, direct communication alone such as by radio may be used.

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- (g) Hand signals to the operator shall be in accordance with those prescribed by the applicable ANSI standard for the type of crane or lift in use unless voice communication equipment is utilized. Signals shall be discernable or audible at all times.
 - (h) Except over water, employees occupying the personnel platform shall use a body belt/harness system with lanyard appropriately attached to the lower load block or overhaul ball, or to a structural member within the personnel platform capable of supporting a fall impact for employees using the anchorage.
 - (i) No lifts shall be made on another of the crane's or derrick's load lines while personnel are suspended on a platform.
- (11) Traveling.
- (a) Hoisting of employees while the crane is traveling is prohibited except for portal, tower and locomotive cranes, or where the employer demonstrates that there is no less hazardous way to perform the work.
 - (b) Under any circumstances where a crane would travel while hoisting personnel, the employer shall implement the following procedures to safeguard employees:
 - (i) Crane travel shall be restricted to a fixed track or runway;
 - (ii) Travel shall be limited to the load radius of the boom used during the lift; and
 - (iii) The boom must be parallel to the direction of travel.
 - (c) A complete trial run shall be performed to test the route of travel before employees are allowed to occupy the platform. This trial run can be performed at the same time as the trial lift required by subsection (9)(a) of this section which tests the route of the lift.
 - (d) If travel is done with a rubber tired-carrier, the condition and air pressure of the tires shall be checked. The chart capacity for lifts on rubber shall be used for application of the fifty percent reduction of rated capacity. Notwithstanding subsection (4)(i) of this section, outriggers may be partially retracted as necessary for travel.
- (12) Prelift meeting.
- (a) A meeting attended by the crane or derrick operator, signal person(s) (if necessary for the lift), employee(s) to be lifted, and the person responsible for the task to be performed shall be held to review the appropriate requirements of this section and the procedures to be followed.
 - (b) This meeting shall be held prior to the trial lift at each new location, and shall be repeated for any employees newly assigned to the operation.

[Statutory Authority: RCW 49.17.010, .040, .050. 00-08-078 (Order 99-15), § 296-24-23533, filed 04/04/00, effective 07/01/00.
Statutory Authority: Chapter 49.17 RCW. 96-09-030, § 296-24-23533, filed 4/10/96, effective 6/1/96; 91-03-044 (Order 90-18), § 296-24-23533, filed 1/10/91, effective 2/12/91.]

WAC 296-24-237 Construction, operation and maintenance-Chain and electric hoists.

- (1) Chain and electric hoists shall be of what is known as "all steel construction." No cast iron shall be used in parts subject to tension except drums, bearings or brake shoes.

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- (2) The chains shall be made of the best quality steel or iron with welded links.
- (3) Chain and electric hoists shall have a factor of safety of at least five.
- (4) Chain and electric hoists shall be equipped with an approved device which will automatically lock the load when hoisting is stopped.
- (5) Electric hoists shall be provided with an approved limit stop to prevent the hoist block from traveling too far in case the operating handle is not released in time.

[Order 73-5, § 296-24-237, filed 5/9/73 and Order 73-4, § 296-24-237, filed 5/7/73.]

WAC 296-24-238 Air hoists.

- (1) To prevent piston rod lock nuts from becoming loose and allowing rod to drop when supporting a load, lock nut shall be secured to piston rod by a castellated nut and cotter-pin.
- (2) A clevis or other means shall be used to prevent hoists cylinder becoming detached from hanger.

[Order 73-5, § 296-24-238, filed 5/9/73 and Order 73-4, § 296-24-238, filed 5/7/73.]

WAC 296-24-240 Crawler locomotive and truck cranes.

[Order 73-5, § 296-24-240, filed 5/9/73 and Order 73-4, § 296-24-240, filed 5/7/73.]

WAC 296-24-24001 Definitions.

- (1) A **“crawler crane”** consists of a rotating superstructure with power plant, operating machinery, and boom, mounted on a base, equipped with crawler treads for travel. Its function is to hoist and swing loads at various radii.
- (2) A **“locomotive crane”** consists of a rotating superstructure with power plant, operating machinery and boom, mounted on a base or car equipped for travel on railroad track. It may be self-propelled or propelled by an outside source. Its function is to hoist and swing loads at various radii.
- (3) A **“truck crane”** consists of a rotating superstructure with power plant, operating machinery and boom, mounted on an automotive truck equipped with a power plant for travel. Its function is to hoist and swing loads at various radii.
- (4) A **“wheel mounted crane”** (wagon crane) consists of a rotating superstructure with power plant, operating machinery and boom, mounted on a base or platform equipped with axles and rubber-tired wheels for travel. The base is usually propelled by the engine in the superstructure, but it may be equipped with a separate engine controlled from the superstructure. Its function is to hoist and swing loads at various radii.
- (5) An **“accessory”** is a secondary part or assembly of parts which contributes to the overall function and usefulness of a machine.
- (6) **“Appointed”** means assigned specific responsibilities by the employer or the employer's representative.
- (7) **“ANSI”** means the American National Standards Institute.
- (8) An **“angle indicator”** (boom) is an accessory which measures the angle of the boom to the horizontal.

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- (9) The **“axis of rotation”** is the vertical axis around which the crane superstructure rotates.
- (10) **“Axle”** means the shaft or spindle with which or about which a wheel rotates. On truck- and wheel-mounted cranes it refers to an automotive type of axle assembly including housings, gearing, differential, bearings, and mounting appurtenances.
- (11) **“Axle”** (bogie) means two or more automotive-type axles mounted in tandem in a frame so as to divide the load between the axles and permit vertical oscillation of the wheels.
- (12) The **“base”** (mounting) is the traveling base or carrier on which the rotating superstructure is mounted such as a car, truck, crawlers, or wheel platform.
- (13) The **“boom”** (crane) is a member hinged to the front of the rotating superstructure with the outer end supported by ropes leading to a gantry or “A” frame and used for supporting the hoisting tackle.
- (14) The **“boom angle”** is the angle between the longitudinal centerline of the boom and the horizontal. The boom longitudinal centerline is a straight line between the boom foot pin (heel pin) centerline and boom point sheave pin centerline.
- (15) The **“boom hoist”** is a hoist drum and rope reeving system used to raise and lower the boom. The rope system may be all live reeving or a combination of live reeving and pendants.
- (16) The **“boom stop”** is a device used to limit the angle of the boom at the highest position.
- (17) A **“brake”** is a device used for retarding or stopping motion by friction or power means.
- (18) A **“cab”** is housing which covers the rotating superstructure machinery and/or operator's station. On truck crane trucks a separate cab covers the driver's station.
- (19) The **“clutch”** is a friction, electromagnetic, hydraulic, pneumatic, or positive mechanical device for engagement or disengagement of power.
- (20) The **“counterweight”** is a weight used to supplement the weight of the machine in providing stability for lifting working loads.
- (21) **“Designated”** means selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.
- (22) The **“drum”** is the cylindrical members around which ropes are wound for raising and lowering the load or boom.
- (23) **“Dynamic”** (loading) means loads introduced into the machine or its components by forces in motion.
- (24) The **“gantry”** (A-frame) is a structural frame, extending above the superstructure, to which the boom supports ropes are reeved.
- (25) A **“jib”** is an extension attached to the boom point to provide added boom length for lifting specified loads. The jib may be in line with the boom or offset to various angles.
- (26) **“Load”** (working) means the external load, in pounds, applied to the crane, including the weight of load-attaching equipment such as load blocks, shackles, and slings.

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- (27) **“Load block”** (upper) means the assembly of hook or shackle, swivel, sheaves, pins, and frame suspended from the boom point.
- (28) **“Load block”** (lower) means the assembly of hook or shackle, swivel, sheaves, pins, and frame suspended by the hoisting ropes.
- (29) A **“load hoist”** is a hoist drum and rope reeving system used for hoisting and lowering loads.
- (30) **“Load ratings”** are crane ratings in pounds established by the manufacturer in accordance with WAC 296-24-24005.
- (31) **“Outriggers”** are extendable or fixed metal arms, attached to the mounting base, which rest on supports at the outer ends.
- (32) **“Rail clamp”** means a tong-like metal device, mounted on a locomotive crane car, which can be connected to the track.
- (33) **“Reeving”** means a rope system in which the rope travels around drums and sheaves.
- (34) **“Rope”** refers to a wire rope unless otherwise specified.
- (35) **“Side loading”** means a load applied at an angle to the vertical plane of the boom.
- (36) A **“standby crane”** is a crane which is not in regular service but which is used occasionally or intermittently as required.
- (37) A **“standing (guy) rope”** is a supporting rope which maintains a constant distance between the points of attachment to the two components connected by the rope.
- (38) **“Structural competence”** means the ability of the machine and its components to withstand the stresses imposed by applied loads.
- (39) **“Superstructure”** means the rotating upper frame structure of the machine and the operating machinery mounted thereon.
- (40) **“Swing”** means the rotation of the superstructure for movement of loads in a horizontal direction about the axis of rotation.
- (41) **“Swing mechanism”** means the machinery involved in providing rotation of the superstructure.
- (42) **“Tackle”** is an assembly of ropes and sheaves arranged for hoisting and pulling.
- (43) **“Transit”** means the moving or transporting of a crane from one jobsite to another.
- (44) **“Travel”** means the functions of the machine moving from one location to another, on a jobsite.
- (45) The **“travel mechanism”** is the machinery involved in providing travel.
- (46) **“Wheelbase”** means the distance between centers of front and rear axles. For a multiple axle assembly the axle center for wheelbase measurement is taken as the midpoint of the assembly.

WAC 296-24-24001 (Cont.)

- (47) The “**whipline**” (auxiliary hoist) is a separate hoist rope system of lighter load capacity and higher speed than provided by the main hoist.
- (48) A “**winch head**” is a power driven spool for handling of loads by means of friction between fiber or wire rope and spool.

[Order 73-5, § 296-24-24001, filed 5/9/73 and Order 73-4, § 296-24-24001, filed 5/7/73.]

WAC 296-24-24003 General requirements.

- (1) Application. This section applies to crawler cranes, locomotive cranes, wheel mounted cranes of both truck and self-propelled wheel type, and any variations thereof which retain the same fundamental characteristics. This section includes only cranes of the above types, which are basically powered by internal combustion engines or electric motors and which utilize drums and ropes. Cranes designed for railway and automobile wreck clearances are excepted. The requirements of these standards are applicable only to machines when used as lifting cranes.
- (2) New and existing equipment. All new crawler, locomotive, and truck cranes constructed and utilized on or after the effective date of these standards, shall meet the design specifications of the American National Standard Safety Code for Crawler, Locomotive, and Truck Cranes, ANSI B 30.5-1968. Crawler, locomotive, and truck cranes constructed prior to the effective date of these standards should be modified to conform to those design specifications by December 31, 1973, unless it can be shown that the crane cannot feasibly or economically be altered and that the crane substantially complies with the requirements of this section. Replacement parts shall be of equal or better quality than the original equipment and suitable for the purpose. Repairs or modifications shall be such as to render the equipment equal to or better than the original construction or design.
- (3) Designated personnel. Only designated personnel shall be permitted to operate a crane covered by this section.

[Order 74-27, § 296-24-24003, filed 5/7/74; Order 73-5, § 296-24-24003, filed 5/9/73 and Order 73-4, § 296-24-24003, filed 5/7/73.]

WAC 296-24-24005 Load ratings.

- (1) Load ratings-Where stability governs lifting performance.
- (a) The margin of stability for determination of load ratings, with booms of stipulated lengths at stipulated working radii for the various types of crane mountings is established by taking a percentage of the loads which will produce a condition of tipping or balance with the boom in the least stable direction, relative to the mounting. The load ratings shall not exceed the following percentages for cranes, with the indicated types of mounting under conditions stipulated in (1)(b) and (c) of this section.

WAC 296-24-24005 (Cont.)

Type of crane mounting:	Maximum load ratings (percent of tipping loads)
Locomotive, without outriggers;	
Booms 60 feet or less	85
Booms over 60 feet	85 ¹
Locomotive, using outriggers fully extended	80
Crawler, without outriggers	75
Crawler, using outriggers fully extended	85
Truck and wheel mounted without outriggers or using outriggers fully extended	85

¹ Unless this results in less than 30,000 pound-feet net stabilizing moment about the rail, which shall be minimum with such booms.

- (b) The following stipulation shall govern the application of the values in (1)(a) of this section for locomotive cranes:
 - (i) Tipping with or without the use of outriggers occurs when half of the wheels farthest from the load leave the rail.
 - (ii) The crane shall be standing on track which is level within 1 percent grade.
 - (iii) Radius of the load is the horizontal distance from a projection of the axis of rotation to the rail support surface, before loading, to the center of vertical hoist line or tackle with load applied.
 - (iv) Tipping loads from which ratings are determined shall be applied under static conditions only, i.e., without dynamic effect of hoisting, lowering, or swinging.
 - (v) The weight of all auxiliary handling devices such as hoist blocks, hooks, and slings shall be considered a part of the load rating.
- (c) Stipulations governing the application of the values in (1)(a) of this section for crawler, truck, and wheel-mounted cranes shall be in accordance with Crane Load-Stability Test Code. Society of Automotive Engineers (SAE) J765.

Note: The effectiveness of these preceding stability factors will be influenced by such additional factors as freely suspended loads, track, wind, or ground conditions, condition and inflation of rubber tires, boom lengths, proper operating speeds for existing conditions, and, in general, careful and competent operation. All of these shall be taken into account by the user.

- (2) Rated capacity chart. A chart indicating the manufacturer's rated capacity at all operating radii for all permissible boom lengths and jib lengths with alternate ratings for optional equipment affecting such ratings shall be posted in all mobile type cranes and shall be readily visible to the operator in the normal operating position.
- (3) Inspection classification. Initial inspection. Prior to initial use all new and altered cranes shall be inspected to insure compliance with provisions of these standards.

WAC 296-24-24005 (Cont.)

- (4) All hooks shall be of the safety latch-type or the hook shall be moused.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-24005, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-24005, filed 7/31/79; Order 73-5, § 296-24-24005, filed 5/9/73 and Order 73-4, § 296-24-24005, filed 5/7/73.]

WAC 296-24-24007 Inspection classification.

- (1) Regular inspection. Inspection procedure for cranes in regular service is divided into two general classifications based upon the intervals at which inspection should be performed. The intervals in turn are dependent upon the nature of the critical components of the crane and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are herein designated as “frequent” and “periodic” with respective intervals between inspections as defined below:
 - (a) Frequent inspection: Daily to monthly intervals.
 - (b) Periodic inspection: One- to 12-month intervals, or as specifically recommended by the manufacturer.
- (2) Frequent inspection. Items such as the following shall be inspected for defects at intervals as defined in (2)(a) of this section or as specifically indicated including observation during operation for any defects which might appear between regular inspection. Any deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:
 - (a) All control mechanisms for maladjustment interfering with proper operation: Daily.
 - (b) All control mechanisms for excessive wear of components and contamination by lubricants or other foreign matter.
 - (c) All safety devices for malfunction.
 - (d) Deterioration or leakage in air or hydraulic systems: Daily.
 - (e) Crane hooks with deformations or cracks. For hooks with cracks or having more than 15 percent in excess of normal throat opening or more than 10° twist from the plane of the unbent hook.
 - (f) Rope reeving for noncompliance with manufacturer's recommendations.
 - (g) Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, and moisture accumulation.
- (3) Periodic inspection. Complete inspections of the crane shall be performed at intervals as generally defined in (2)(b) of this section depending upon its activity, severity of service, and environment, or as specifically indicated below. These inspections shall include the requirements of (3) of this section and in addition, items such as the following. Any deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:
 - (a) Deformed, cracked, or corroded members, in the crane structure and boom.
 - (b) Loose bolts or rivets.

WAC 296-24-24007 (Cont.)

- (c) Cracked or worn sheaves and drums.
 - (d) Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers and locking devices.
 - (e) Excessive wear on brake and clutch system parts, linings, pawls, and ratchets.
 - (f) Load, boom angle, and other indicators over their full range, for any significant inaccuracies.
 - (g) Gasoline, diesel, electric, or other power plants for improper performance or noncompliance with safety requirements.
 - (h) Excessive wear of chain-drive sprockets and excessive chain stretch.
 - (i) Travel steering, braking, and locking devices, for malfunction.
 - (j) Excessively worn or damaged tires.
- (4) Cranes not in regular use.
- (a) A crane which has been idle for a period of one month or more, but less than 6 months, shall be given an inspection conforming with requirements of (3) of this section and WAC 296-24-24013 (2)(b) before placing in service.
 - (b) A crane which has been idle for a period of six months shall be given a complete inspection conforming with requirements of (3) and (4) of this section and WAC 296-24-24013 (2)(b) before placing in service.
 - (c) Standby cranes shall be inspected at least semi-annually in accordance with requirements of (3) of this section and WAC 296-24-24013 (2)(b). Such cranes which are exposed to adverse environment should be inspected more frequently.
- (5) Inspection records. Written, dated, and signed inspection reports and records shall be made monthly on critical items in use such as brakes, crane hooks, and ropes. Records shall be kept readily available.
[Order 73-5, § 296-24-24007, filed 5/9/73 and Order 73-4, § 296-24-24007, filed 5/7/73.]

WAC 296-24-24009 Testing.

- (1) Operational tests.
- (a) In addition to prototype tests and quality-control measures, the user of each new production crane shall require that it be tested and related data supplied by the manufacturer to the extent necessary to assure compliance with the operational requirements of this subsection including functions such as the following:
 - (i) Load hoisting and lowering mechanisms
 - (ii) Boom hoisting and lower mechanisms
 - (iii) Swinging mechanism

WAC 296-24-24009 (Cont.)

- (iv) Travel mechanism
 - (v) Safety devices
- (b) Where the complete production crane is not supplied by one manufacturer such tests shall be conducted at final assembly.
- (c) Certified production-crane test results shall be made available.
- (2) Rated load test.
 - (a) Written reports shall be available showing test procedures and confirming the adequacy of repairs or alterations.
 - (b) Test loads shall not exceed 110 percent of the rated load at any selected working radius.
 - (c) Where rerating is necessary:
 - (i) Crawler, truck, and wheel-mounted cranes shall be tested in accordance with SAE Recommended Practice, Crane Load Stability Test Code J765 (April 1961).
 - (ii) Locomotive cranes shall be tested in accordance with WAC 296-24-24005 (1)(a) and (b).
 - (iii) Rerating test report shall be readily available.
 - (d) No cranes shall be rerated in excess of the original load ratings unless such rating changes are approved by the crane manufacturer or final assembler.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-24009, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-24009, filed 5/9/73 and Order 73-4, § 296-24-24009, filed 5/7/73.]

WAC 296-24-24011 Maintenance procedure.

- (1) Any unsafe conditions disclosed by the inspection requirements of this section shall be corrected before operation of the crane is resumed. Adjustments and repairs shall be done only by designated personnel.
- (2) After adjustments and repairs have been made the crane shall not be operated until all guards have been reinstalled, safety devices reactivated, and maintenance equipment removed.

[Order 73-5, § 296-24-24011, filed 5/9/73 and Order 73-4, § 296-24-24011, filed 5/7/73.]

WAC 296-24-24013 Rope inspection.

- (1) Running ropes. A thorough inspection of all ropes in use shall be made at least once a month and a full written, dated, and signed report of rope condition kept on file where readily available. All inspections shall be performed by an appointed or authorized person. Any deterioration, resulting in appreciable loss of original strength, such as described below, shall be carefully noted and determination made as to whether further use of the rope would constitute a safety hazard:
 - (a) Reduction of rope diameter below nominal diameter due to loss of core support, internal, or external corrosion or wear of outside wires.

WAC 296-24-24013 (Cont.)

- (b) A number of broken outside wires and the degree of distribution of concentration of such broken wires.
 - (c) Worn outside wires.
 - (d) Corroded or broken wires at end connections.
 - (e) Corroded, cracked, bent, worn, or improperly applied end connections.
 - (f) Severe kinking, crushing, cutting, or unstranding.
- (2) Other ropes.
- (a) Heavy wear and/or broken wires may occur in sections in contact with equalizer sheaves or other sheaves where rope travel is limited, or with saddles. Particular care shall be taken to inspect ropes at these locations.
 - (b) All rope which has been idle for a period of a month or more due to shut down or storage of a crane on which it is installed shall be given a thorough inspection before it is placed in service. This inspection shall be for all types of deterioration and shall be performed by an appointed or authorized person whose approval shall be required for further use of the rope. A written and dated report of the rope condition shall be available.
 - (c) Particular care shall be taken in the inspection of nonrotating rope.
- [Order 73-5, § 296-24-24013, filed 5/9/73 and Order 73-4, § 296-24-24013, filed 5/7/73.]

WAC 296-24-24015 Handling the load.

- (1) Size of load.
- (a) No crane shall be loaded beyond the rated load, except for test purposes as provided in WAC 296-24-24009.
 - (b) When loads which are limited by structural competence rather than by stability are to be handled, it shall be ascertained that the weight of the load has been determined within plus or minus 10 percent before it is lifted.
- (2) Attaching the load.
- (a) The hoist rope shall not be wrapped around the load.
 - (b) The load shall be attached to the hook by means of slings or other approved devices.
- (3) Moving the load.
- (a) The employer shall assure that:
 - (i) The crane is level and where necessary blocked properly.
 - (ii) The load is well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches.

WAC 296-24-24015 (Cont.)

- (b) Before starting to hoist, the following conditions shall be noted:
 - (i) Hoist rope shall not be kinked.
 - (ii) Multiple part lines shall not be twisted around each other.
 - (iii) The hook shall be brought over the load in such a manner as to prevent swinging.
 - (iv) If there is a slack rope condition, it should be determined that the rope is properly seated on the drum and in the sheaves.
- (c) During hoisting care shall be taken that:
 - (i) There is no sudden acceleration or deceleration of the moving load.
 - (ii) The load does not contact any obstructions.
- (d) Side loading of booms shall be limited to freely suspended loads. Cranes shall not be used for dragging loads sideways.
- (e) No hoisting, lowering, swinging, or traveling shall be done while anyone is on the load or hook.
- (f) The operator should avoid carrying loads over people.
- (g) On truck mounted cranes, no loads shall be lifted over the front area except as approved by the crane manufacturer.
- (h) The operator shall test the brakes each time a load approaching the rated load is handled by raising it a few inches and applying the brakes.
- (i) Outriggers shall be used when the load to be handled at that particular radius exceeds the rated load without outriggers as given by the manufacturer for that crane. Where floats are used they shall be securely attached to the outriggers. Wood blocks used to support outriggers shall:
 - (i) Be strong enough to prevent crushing.
 - (ii) Be free from defects.
 - (iii) Be of sufficient width and length to prevent shifting or toppling under load.
- (j) Neither the load nor the boom shall be lowered below the point where less than two full wraps of rope remain on their respective drums.
- (k) Before lifting loads with locomotive cranes without using outriggers, means shall be applied to prevent the load from being carried by the truck springs.
- (l) When two or more cranes are used to lift one load, one designated person shall be responsible for the operation. They shall be required to analyze the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made.

WAC 296-24-24015 (Cont.)

- (m) In transit the following additional precautions shall be exercised.
 - (i) The boom shall be carried in line with the direction of motion.
 - (ii) The superstructure shall be secured against rotation, except when negotiating turns when there is an operator in the cab or the boom is supported on a dolly.
 - (iii) The empty hook shall be lashed or otherwise restrained so that it cannot swing freely.
- (n) Before traveling a crane with load, a designated person shall be responsible for determining and controlling safety. Decisions such as position of load, boom location, ground support, travel route, and speed of movement shall be in accord with their determinations.
- (o) A crane with or without load shall not be traveled with the boom so high that it may bounce back over the cab.
- (p) When rotating the crane, sudden starts and stops shall be avoided. Rotational speed shall be such that the load does not swing out beyond the radii at which it can be controlled. A tag or restraint line shall be used when rotation of the load is hazardous.
- (q) When a crane is to be operated at a fixed radius, the boom-hoist pawl or other positive locking device shall be engaged.
- (r) Ropes shall not be handled on a winch head without the knowledge of the operator.
- (s) While a winch head is being used, the operator shall be within convenient reach of the power unit control lever.
- (4) Holding the load.
 - (a) The operator shall not be permitted to leave the control position while the load is suspended.
 - (b) No person should be permitted to stand or pass under a load on the hook.
 - (c) If the load must remain suspended for any considerable length of time, the operator shall hold the drum from rotating in the lowering direction by activating the positive controllable means of the operator's station.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-24015, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-24015, filed 5/9/73 and Order 73-4, § 296-24-24015, filed 5/7/73.]

WAC 296-24-24017 Other requirements.

- (1) Rail clamps. Rail clamps shall not be used as a means of restraining tipping of a locomotive crane.
- (2) Ballast or counterweight. Cranes shall not be operated without the full amount of any ballast or counterweight in place as specified by the maker, but truck cranes that have dropped the ballast or counterweight may be operated temporarily with special care and only for light loads without full ballast or counterweight in place. The ballast or counterweight in place specified by the manufacturer shall not be exceeded.

WAC 296-24-24017 (Cont.)

- (3) Cabs.
 - (a) Necessary clothing and personal belongings shall be stored in such a manner as to not interfere with access or operation.
 - (b) Tools, oil cans, waste, extra fuses, and other necessary articles shall be stored in the tool box, and shall not be permitted to lie loose in or about the cab.
- (4) Refueling.
 - (a) Refueling with small portable containers shall be done with an approved safety type can equipped with an automatic closing cap and flame arrester. Refer to WAC 296-24-58501(19) for definition of approved.
 - (b) Machines shall not be refueled with the engine running.
- (5) Fire extinguishers.
 - (a) A carbon dioxide, dry chemical, or equivalent fire extinguisher shall be kept in the cab or vicinity of the crane.
 - (b) Operating and maintenance personnel shall be made familiar with the use and care of the fire extinguishers provided.
- (6) Swinging locomotive cranes. A locomotive crane shall not be swung into a position where railway cars on an adjacent track might strike it, until it has been ascertained that cars are not being moved on the adjacent track and proper flag protection has been established.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-24-24017, filed 11/14/88; Order 73-5, § 296-24-24017, filed 5/9/73 and Order 73-4, § 296-24-24017, filed 5/7/73.]

WAC 296-24-24019 Operating near overhead electric power lines.

- (1) For operations near overhead electric lines see chapter 296-24 WAC Part L.
- (2) Boom guards. Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not operate to alter the requirements of (1) of this section.
- (3) Notification. Before the commencement of operations near electrical lines, the owners of the lines or their authorized representative shall be notified and provided with all pertinent information. The cooperation of the owner shall be requested.
- (4) Overhead wires. Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-24019, filed 11/22/91, effective 12/24/91; Order 73-5, § 296-24-24019, filed 5/9/73 and Order 73-4, § 296-24-24019, filed 5/7/73.]

WAC 296-24-245 Derricks.

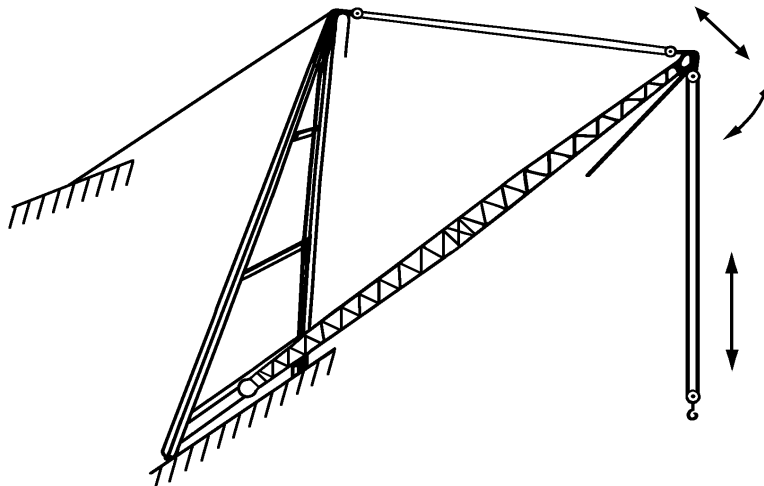
[Order 73-5, § 296-24-245, filed 5/9/73 and Order 73-4, § 296-24-245, filed 5/7/73.]

WAC 296-24-24501 Definitions.

- (1) A “**derrick**” is an apparatus consisting of a mast or equivalent member held at the head by guys or braces, with or without a boom, for use with a hoisting mechanism and operating ropes.

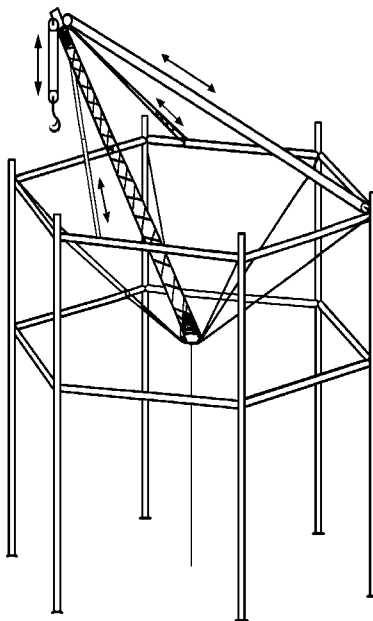
WAC 296-24-24501 (Cont.)

- (2) A **“frame derrick”** means a derrick in which the boom is hinged from a cross member between the bottom ends of two upright members spread apart at the lower ends and joined at the top; the boom point secured to the junction of the side members, and the side members are braced or guyed from this junction point.



A-FRAME

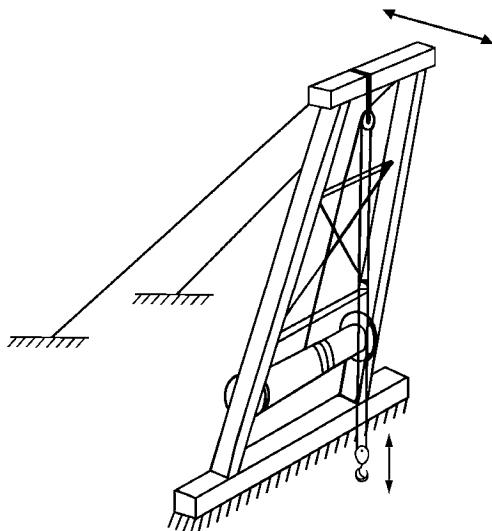
- (3) A **“basket derrick”** is a derrick without a boom, similar to a gin pole with its base supported by ropes attached to corner posts or other parts of the structure. The base is at a lower elevation than its supports. The location of the base of a basket derrick can be changed by varying the length of the rope supports. The top of the pole is secured with multiple reeved guys to position the top of the pole to the desired location by varying the length of the upper guy lines. The load is raised and lowered by ropes through a sheave or block secured to the top of the pole.



BASKET

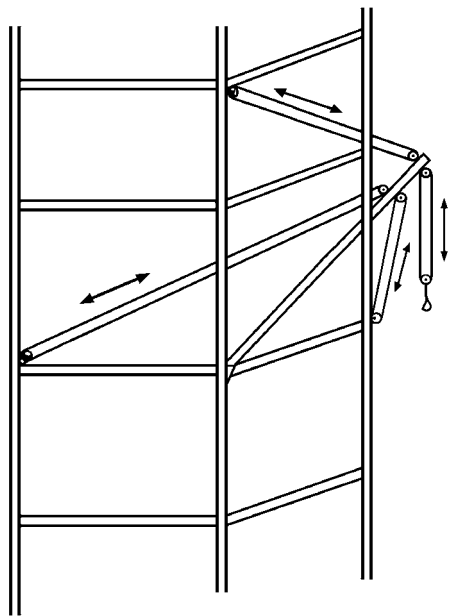
WAC 296-24-24501 (Cont.)

- (4) **“Breast derrick”** means a derrick without boom. The mast consists of two side members spread farther apart at the base than at the top and tied together at top and bottom by rigid members. The mast is prevented from tipping forward by guys connected to its top. The load is raised and lowered by ropes through a sheave or block secured to the top crosspiece.



BREAST

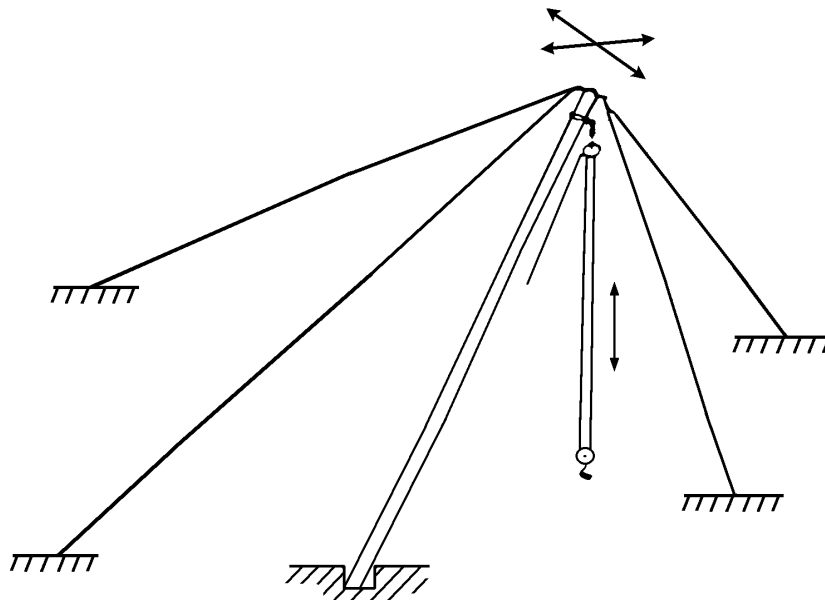
- (5) **“Chicago boom derrick”** means a boom which is attached to a structure, and outside upright member of the structure serving as the mast, and the boom being stepped in a fixed socket clamped to the upright. The derrick is complete with load, boom, and boom point swing line falls.



CHICAGO BOOM

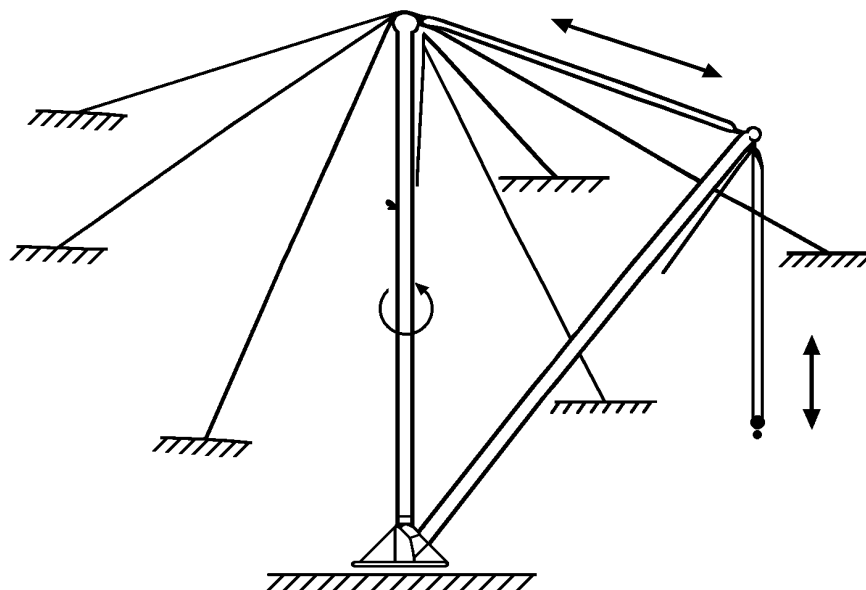
WAC 296-24-24501 (Cont.)

- (6) A “**gin pole derrick**” is a derrick without a boom. Its guys are so arranged from its top as to permit leaning the mast in any direction. The load is raised and lowered by ropes reeved through sheaves or blocks at the top of the mast.



GIN POLE

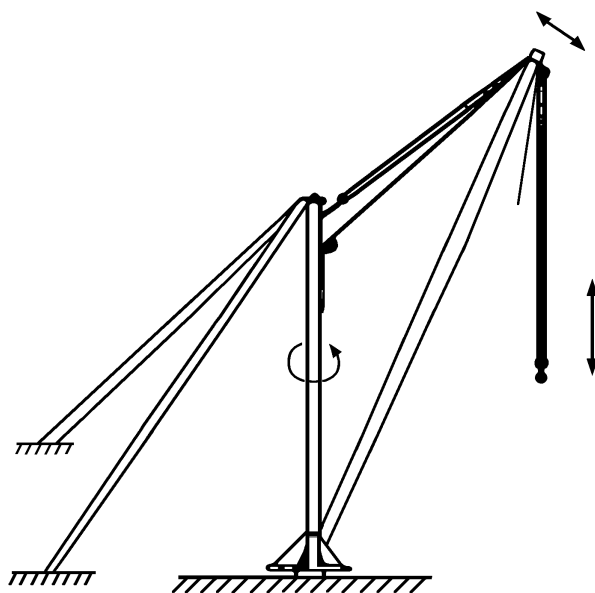
- (7) “**Guy derrick**” means a fixed derrick consisting of a mast capable of being rotated, supported in a vertical position by guys, and a boom whose bottom end is hinged or pivoted to move in a vertical plane with a reeved rope between the head of the mast and the boom point for raising and lowering the boom, and a reeved rope from the boom point for raising and lowering the load.



GUY

WAC 296-24-24501 (Cont.)

- (8) “Shearleg derrick” means a derrick without a boom and similar to a breast derrick. The mast, wide at the bottom and narrow at the top, is hinged at the bottom and has its top secured by a multiple reeved guy to permit handling loads at various radii by means of load tackle suspended from the mast top.
- (9) A “stiffleg derrick” is a derrick similar to a guy derrick except that the mast is supported or held in place by two or more stiff members, called stifflegs, which are capable of resisting either tensile or compressive forces. Sills are generally provided to connect the lower ends of the stifflegs to the foot of the mast.



STIFF LEG

- (10) “**Appointed**” means assigned specific responsibilities by the employer or the employer's representative.
- (11) “**ANSI**” means the American National Standards Institute.
- (12) A “**boom**” is a timber or metal section or strut, pivoted or hinged at the heel (lower end) at a location fixed in height on a frame or mast or vertical member, and with its point (upper end) supported by chains, ropes, or rods to the upper end of the frame mast, or vertical member. A rope for raising and lowering the load is reeved through sheaves or a block at the boom point. The length of the boom shall be taken as the straight line distance between the axis of the foot pin and the axis of the boom point sheave pin, or where used, the axis of the upper load block attachment pin.
- (13) “**Boom harness**” means the block and sheave arrangement on the boom point to which the topping lift cable is reeved for lowering and raising the boom.
- (14) The “**boom point**” is the outward end of the top section of the boom.
- (15) “**Derrick bullwheel**” means a horizontal ring or wheel, fastened to the foot of a derrick, for the purpose of turning the derrick by means of ropes leading from this wheel to a powered drum.

WAC 296-24-24501 (Cont.)

- (16) **“Designated”** means selected or assigned by the employer or employer's representative as being qualified to perform specific duties.
- (17) **“Eye”** means a loop formed at the end of a rope by securing the dead end to the live end at the base of the loop.
- (18) A **“fiddle block”** is a block consisting of two sheaves in the same plane held in place by the same cheek plates.
- (19) The **“foot bearing”** or **“foot block”** (sill block) is the lower support on which the mast rotates.
- (20) A **“gudgeon pin”** is a pin connecting the mast cap to the mast allowing rotation of the mast.
- (21) A **“guy”** is a rope used to steady or secure the mast or other member in the desired position.
- (22) **“Load, working”** means the external load, in pounds, applied to the derrick, including the weight of load attaching equipment such as load blocks, shackles, and slings.
- (23) **“Load block, lower”** means the assembly of sheaves, pins, and frame suspended by the hoisting rope.
- (24) **“Load block, upper”** means the assembly of sheaves, pins, and frame suspended from the boom.
- (25) **“Mast”** means the upright member of the derrick.
- (26) **“Mast cap (spider)”** means the fitting at the top of the mast to which the guys are connected.
- (27) **“Reeving”** means a rope system in which the rope travels around drums and sheaves.
- (28) **“Rope”** refers to wire rope unless otherwise specified.
- (29) **“Safety hook”** means a hook with a latch to prevent slings or load from accidentally slipping off the hook.
- (30) **“Side loading”** is a load applied at an angle to the vertical plane of the boom.
- (31) The **“sill”** is a member connecting the foot block and stiffleg or a member connecting the lower ends of a double member mast.
- (32) A **“standby derrick”** is a derrick not in regular service which is used occasionally or intermittently as required.
- (33) **“Stiff leg”** means a rigid member supporting the mast at the head.
- (34) **“Swing”** means rotation of the mast and/or boom for movements of loads in a horizontal direction about the axis of rotation.

[Order 73-5, § 296-24-24501, filed 5/9/73 and Order 73-4, § 296-24-24501, filed 5/7/73.]

WAC 296-24-24503 General requirements.

- (1) Application. This section applies to guy, stiffleg, basket, breast, gin pole, Chicago boom and A-frame derricks of the stationary type, capable of handling loads at variable reaches and powered by hoists through systems of rope reeving, used to perform lifting hook work, single or multiple line bucket work, grab, grapple, and magnet work. Derricks may be permanently installed for temporary use as in construction work. The requirements of this section also apply to any modification of these types which retain their fundamental features, except for floating derricks.
- (2) New and existing equipment. All new derricks constructed and installed on or after the effective date of these standards shall meet the design specifications of the "American National Standards Institute, Safety Code for Derricks, ANSI B30.6-1969." Derricks constructed prior to the effective date of these standards should be modified to conform to these design specifications by December 31, 1973 unless it can be shown that the derrick cannot feasibly or economically be altered and that the derrick substantially complies with the requirements of this section.
 - (a) Operating controls shall be marked or an explanation of the controls shall be posted in full view of the operator.
 - (b) Cranes or derricks having a movable working boom shall have a radius or boom angle indicator installed. This shall be located where the operator can readily read it from the normal operating position.
 - (c) Top of boom painted. The top six feet of the boom or jib shall be painted bright yellow.
- (3) Designated personnel. Only designated personnel shall be permitted to operate a derrick covered by this section.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-24503, filed 7/20/94, effective 9/20/94; Order 76-6, § 296-24-24503, filed 3/1/76; Order 73-5, § 296-24-24503, filed 5/9/73 and Order 73-4, § 296-24-24503, filed 5/7/73.]

WAC 296-24-24505 Load ratings.

- (1) Rated load marking. For permanently installed derricks with fixed lengths of boom, guy, and mast, a substantial, durable, and clearly legible rating chart shall be provided with each derrick and securely affixed where it is visible to personnel responsible for the safe operation of the equipment. The chart shall include the following data:
 - (a) Manufacturer's approved load ratings at corresponding ranges of boom angle or operating radii.
 - (b) Specific lengths of components on which the load ratings are based.
 - (c) Required parts for hoist reeving. Size and construction of rope may be shown either on the rating chart or in the operating manual.
- (2) Nonpermanent installations. For nonpermanent installations, the employer shall provide sufficient information from which capacity charts can be prepared for the particular installation. The capacity charts shall be located at the derricks or the jobsite office.

[Order 73-5, § 296-24-24505, filed 5/9/73 and Order 73-4, § 296-24-24505, filed 5/7/73.]

WAC 296-24-24507 Inspection.

- (1) Inspection classification.
 - (a) Prior to initial use all new and altered derricks shall be inspected to insure compliance with the provisions of these standards.
 - (b) Inspection procedure for derricks in regular service is divided into two general classifications based upon the intervals at which inspection should be performed. The intervals in turn are dependent upon the nature of the critical components of the derrick and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are herein designated as frequent and periodic with respective intervals between inspections as defined below:
 - (i) Frequent inspection - daily to monthly intervals.
 - (ii) Periodic inspection - 1- to 12-month intervals, or as specified by the manufacturer.
- (2) Frequent inspection. Items such as the following shall be inspected for defects at intervals as defined in (1)(b)(i) of this section or as specifically indicated, including observation during operation for any defects which might appear between regular inspections. Deficiencies shall be carefully examined for any safety hazard.
 - (a) All control mechanisms: Inspect daily for adjustment, wear, and lubrication.
 - (b) All chords and lacing: Inspect daily, visually.
 - (c) Tension in guys: Daily.
 - (d) Plumb of the mast.
 - (e) Deterioration or leakage in air or hydraulic systems: Daily.
 - (f) Derrick hooks for deformations or cracks; for hooks with cracks or having more than 15 percent in excess of normal throat opening or more than 10° twist from the plane of the unbent hook, refer to WAC 296-24-24511 (3)(c).
 - (g) Rope reeving; visual inspection for noncompliance with derrick manufacturer's recommendations.
 - (h) Hoist brakes, clutches, and operating levers: Check daily for proper functioning before beginning operations.
 - (i) Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, and moisture accumulation.
- (3) Periodic inspection.
 - (a) Complete inspections of the derrick shall be performed at intervals as generally defined in (1)(b)(ii) of this section depending upon its activity, severity of service, and environment, or as specifically indicated below. These inspections shall include the requirements of (2) of this section and in addition, items such as the following. Deficiencies shall be carefully examined and a determination made as to whether they constitute a safety hazard:
 - (i) Structural members for deformations, cracks, and corrosion.

WAC 296-24-24507 (Cont.)

- (ii) Bolts or rivets for tightness.
 - (iii) Parts such as pins, bearings, shafts, gears, sheaves, drums, rollers, locking and clamping devices, for wear, cracks, and distortion.
 - (iv) Gudgeon pin for cracks, wear, and distortion each time the derrick is to be erected.
 - (v) Power plants for proper performance and compliance with applicable safety requirements.
 - (vi) Hooks: Magnetic particle or other suitable crack detecting inspection should be performed at least once each year.
- (b) Foundation or supports shall be inspected for continued ability to sustain the imposed loads.
- (4) Derricks not in regular use.
 - (a) A derrick which has been idle for a period of 1 month or more, but less than 6 months, shall be given an inspection conforming with requirements of (2) of this section and WAC 296-24-24513(2) before placing in service.
 - (b) A derrick which has been idle for a period of over 6 months shall be given a complete inspection conforming with requirements of (2) and (3) of this section and WAC 296-24-24513(3) before placing in service.
 - (c) Standby derricks shall be inspected at least semiannually in accordance with requirements of (2) of this section and WAC 296-24-24513(3). Those exposed to adverse environment should be inspected more frequently.

[Order 73-5, § 296-24-24507, filed 5/9/73 and Order 73-4, § 296-24-24507, filed 5/7/73.]

WAC 296-24-24509 Testing.

- (1) Operational tests. Prior to initial use all new and altered derricks shall be tested to ensure compliance with this section including the following functions:
 - (a) Load hoisting and lowering.
 - (b) Boom up and down.
 - (c) Swing.
 - (d) Operation of clutches and brakes of hoist.
- (2) Anchorages. All anchorages shall be approved by the appointed person. Rock and hairpin anchorages may require special testing.

[Order 73-5, § 296-24-24509, filed 5/9/73 and Order 73-4, § 296-24-24509, filed 5/7/73.]

WAC 296-24-24511 Maintenance.

- (1) Preventive maintenance. A preventive maintenance program based on the derrick manufacturer's recommendations shall be established.
- (2) Maintenance procedure.
 - (a) Before adjustments and repairs are started on a derrick the following precautions shall be taken:
 - (i) The derrick to be repaired shall be arranged so it will cause the least interference with other equipment and operations in the area.
 - (ii) All hoist drum dogs shall be engaged.
 - (iii) The main or emergency switch shall be locked in the open position, if an electric hoist is used.
 - (iv) Warning or out of order signs shall be placed on the derrick and hoist.
 - (v) The repairs of booms or derricks shall either be made when the booms are lowered and adequately supported or safely tied off.
 - (vi) A good communication system shall be set up between the hoist operator and the appointed individual in charge of the derrick operations before any work on the equipment is started.
 - (vii) Welding repairs shall be approved by an appointed person.
 - (b) After adjustments and repairs have been made the derrick shall not be operated until all guards have been reinstalled, safety devices reactivated, and maintenance equipment removed.
- (3) Adjustments and repairs.
 - (a) Any unsafe conditions disclosed by inspection shall be corrected before operation of the derrick is resumed.
 - (b) Adjustments shall be maintained to assure correct functioning of components.
 - (c) Repairs or replacements shall be provided promptly as needed for safe operation. The following are examples of conditions requiring prompt repair or replacement:
 - (i) Hooks showing defects described in WAC 296-24-24507 (2)(f) shall be discarded.
 - (ii) All critical parts which are cracked, broken, bent, or excessively worn.
 - (iii) Pitted or burned electrical contacts should be corrected only by replacement and in sets. Controller parts should be lubricated as recommended by the manufacturer.
 - (iv) All replacement and repaired parts shall have at least the original safety factor.

[Order 73-5, § 296-24-24511, filed 5/9/73 and Order 73-4, § 296-24-24511, filed 5/7/73.]

WAC 296-24-24513 Rope inspection.

- (1) Running ropes. A thorough inspection of all ropes in use shall be made at least once a month and a full written, dated, and signed report of rope condition kept on file where readily available. Any deterioration, resulting in appreciable loss of original strength, such as described below, shall be carefully noted and determination made as to whether further use of the rope would constitute a safety hazard:
 - (a) Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.
 - (b) A number of broken outside wires and the degree of distribution or concentration of such broken wires.
 - (c) Worn outside wires.
 - (d) Corroded or broken wires at end connections.
 - (e) Corroded, cracked, bent, worn, or improperly applied end connections.
 - (f) Severe kinking, crushing, cutting, or unstranding.
- (2) Idle ropes. All rope which has been idle for a period of a month or more due to shutdown or storage of derrick on which it is installed shall be given a thorough inspection before it is placed in service. This inspection shall be for all types of deterioration. A written and dated report of the rope condition shall be available.
- (3) Nonrotating ropes. Particular care shall be taken in the inspection of nonrotating rope.

Note: Limited travel ropes. Heavy wear and/or broken wires may occur in sections in contact with equalizer sheaves or other sheaves where rope travel is limited, or with saddles. Particular care shall be taken to inspect ropes at these locations.

[Order 73-5, § 296-24-24513, filed 5/9/73 and Order 73-4, § 296-24-24513, filed 5/7/73.]

WAC 296-24-24515 Operations of derricks. Derrick operation shall be directed only by the individual specifically designated for that purpose.

[Order 73-5, § 296-24-24515, filed 5/9/73 and Order 73-4, § 296-24-24515, filed 5/7/73.]

WAC 296-24-24517 Handling the load.

- (1) Size of load.
 - (a) No derrick shall be loaded beyond the rated load.
 - (b) When loads approach the maximum rating of the derrick, it shall be ascertained that the weight of the load has been determined within plus or minus 10 percent before it is lifted.
- (2) Attaching the load.
 - (a) The hoist rope shall not be wrapped around the load.
 - (b) The load shall be attached to the hook by means of slings or other suitable devices.

WAC 296-24-24517 (Cont.)

- (3) Moving the load.
 - (a) The load shall be well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches.
 - (b) Before starting to hoist, the following conditions shall be noted:
 - (i) Hoist rope shall not be kinked.
 - (ii) Multiple part lines shall not be twisted around each other.
 - (iii) The hook shall be brought over the load in such a manner as to prevent swinging.
 - (iv) If there is a slack rope condition, it should be determined that the rope is properly seated on the drum and in the sheaves.
 - (c) During hoisting, care shall be taken that:
 - (i) There is no sudden acceleration or deceleration of the moving load.
 - (ii) Load does not contact any obstructions.
 - (d) A derrick shall not be used for side loading except when specifically authorized by a responsible person who has determined that the various structural components will not be overstressed.
 - (e) No hoisting, lowering, or swinging shall be done while anyone is on the load or hook.
 - (f) The operator shall avoid carrying loads over people.
 - (g) The operator shall test the brakes each time a load approaching the rated load is handled by raising it a few inches and applying the brakes.
 - (h) Neither the load nor boom shall be lowered below the point where less than two full wraps of rope remain on their respective drums.
 - (i) When rotating a derrick, sudden starts and stops shall be avoided. Rotational speed shall be such that the load does not swing out beyond the radius at which it can be controlled.
 - (j) Boom and hoisting rope systems shall not be twisted.
- (4) Holding the load.
 - (a) The operator shall not be allowed to leave the control position while the load is suspended.
 - (b) People should not be permitted to stand or pass under a load on the hook.
 - (c) If the load must remain suspended for any considerable length of time, a dog, or pawl and ratchet, or other equivalent means, rather than the brake alone, shall be used to hold the load.

WAC 296-24-24517 (Cont.)

- (5) Use of winch heads.
 - (a) Ropes shall not be handled on a winch head without the knowledge of the operator.
 - (b) While a winch head is being used, the operator shall be within convenient reach of the power unit control lever.
- (6) Securing boom. Dogs, pawls, or other positive holding mechanism on the hoist shall be engaged. When not in use, the derrick boom shall:
 - (a) Be laid down;
 - (b) Be secured to a stationary member, as nearly under the head as possible, by attachment of a sling to the load block; or
 - (c) Be hoisted to a vertical position and secured to the mast.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-24517, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-24517, filed 5/9/73 and Order 73-4, § 296-24-24517, filed 5/7/73.]

WAC 296-24-24519 Other requirements.

- (1) Guards.
 - (a) Exposed moving parts, such as gears, ropes, setscrews, projecting keys, chains, chain sprockets, and reciprocating components, which constitute a hazard under normal operating conditions shall be guarded.
 - (b) Guards shall be securely fastened.
 - (c) Each guard shall be capable of supporting without permanent distortion, the weight of a two hundred-pound person unless the guard is located where it is impossible for a person to step on it.
- (2) Hooks.
 - (a) Hooks shall meet the manufacturer's recommendations and shall not be overloaded.
 - (b) Safety latch type hooks shall be used or the hooks shall be moused.
- (3) Fire extinguishers.
 - (a) A carbon dioxide, dry chemical, or equivalent fire extinguisher shall be kept in the immediate vicinity of the derrick.
 - (b) Operating and maintenance personnel shall be familiar with the use and care of the fire extinguishers proved.
- (4) Refueling.
 - (a) Refueling with portable containers shall be done with approved safety type containers equipped with automatic closing spout and flame arrester. Refer to WAC 296-24-58501(19) for definition of approved.

WAC 296-24-24519 (Cont.)

- (b) Machines shall not be refueled with the engine running.
- (5) Operating near electric powerlines. For operations near overhead electric lines see chapter 296-24 WAC Part L.
- (6) Cab or operating enclosure.
 - (a) Necessary clothing and personnel belongings shall be stored in such a manner as to not interfere with access or operation.
 - (b) Tools, oilcans, waste, extra fuses, and other necessary articles shall be stored in the toolbox, and shall not be permitted to lie loose in or about the cab or operating enclosure.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-24519, filed 11/22/91, effective 12/24/91; 88-23-054 (Order 88-25), § 296-24-24519, filed 11/14/88. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-24519, filed 7/31/79; Order 73-5, § 296-24-24519, filed 5/9/73 and Order 73-4, § 296-24-24519, filed 5/7/73.]

WAC 296-24-293 "A" frames.

- (1) All timbers for "A" frames shall be of correct size, length, and condition to sustain the maximum contemplated loads.
- (2) "A" frame timbers shall be braced with two spreaders spaced one-quarter the length of the "A" frame from each end. Cross bracing shall cross between the two spreaders. Bracing material shall be not less than two-thirds of the rated strength of the "A" frame timbers.
- (3) Tie rods (staybolts) of not less than one-twelfth the diameter of the main "A" frame timbers shall be used. Tie rods shall be placed directly above the upper spreader and directly below the lower spreader. Ends of bolts shall be secured at each end with malleable washers and nuts.
- (4) The base of the "A" frame shall be securely anchored. Elevating type "A" frames shall be set in pinion-type sockets. Pinion bases shall be securely anchored.
- (5) Guy lines shall be of sufficient strength to carry the load imposed upon them and shall be securely fastened in place.

[Order 73-5, § 296-24-293, filed 5/9/73 and Order 73-4, § 296-24-293, filed 5/7/73.]

WAC 296-24-294 Rigging.

[Order 73-5, § 296-24-294, filed 5/9/73 and Order 73-4, § 296-24-294, filed 5/7/73.]

WAC 296-24-29401 Wire rope.

- (1) Safe loads. Whenever used in connection with work, employment, occupations or uses to which these standards are applicable, wire rope shall not be subjected to loads in excess of one-fifth the breaking load as given in the schedule of the cable manufacturer. Except as required in standard for material hoists.
- (2) Condemned. When cables deteriorate through rust, wear, broken wires, undue strain or other conditions to the extent of fifteen percent of their original strength, use of cables shall be discontinued.
- (3) Straps and ribbons. The strap or steel ribbon type of cable shall not be used in the suspension of scaffolding.
- (4) Inspections. There shall be not less than monthly inspection of all wire rope in use, and all wire rope must be inspected before put into use.

WAC 296-24-29401 (Cont.)

- (5) Fastening. The following methods of fastening and attaching wire rope shall be adhered to:
- (a) Sockets. The end of wire rope to be set into socket fittings held securely with molten babbitt or zinc (not lead). The wires of the cable shall be frayed out and each wire bent toward the outside of socket, so that the end of each wire projects well into the depth of the socket. This method of fastening cables should be left in the hands of an experienced workers in this kind of work.
 - (b) Wrapping. Thimbles spliced into rope and the splice securely wrapped.
 - (c) Bolted. Thimbles inserted and held in place by at least a three bolt clamp or three U-bolt clips. Clamps shall be of standard size for the sizes of the cable in use.
 - (d) Lashing. For temporary work, by-passing rope at least twice around large object such as a post, avoiding sharp points and carrying the end back several feet and securing it by clamps, clips or lashing to the cable.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-29401, filed 7/20/94, effective 9/20/94; Order 76-29, § 296-24-29401, filed 9/30/76; Order 73-5, § 296-24-29401, filed 5/9/73 and Order 73-4, § 296-24-29401, filed 5/7/73.]

WAC 296-24-29403 Hemp rope.

- (1) Quality. Whenever hemp rope is used it shall be first grade long fiber Manila hemp rope.
- (2) Strength. Rope shall not be used to support loads in excess of those given in table for hemp and Manila rope.
- (3) Lashed. Supporting ropes shall be double lashed at each point of suspension.
- (4) Pads. Where supporting ropes are brought over sharp corners of steel, stone, or other material liable to cut the rope, or are in any other way subject to abrasion, they shall be protected at such points by the use of bagging, wooden blocks or other protective padding.
- (5) Knot ends. Rope knots shall have their loose and free ends lashed to the standing part in order to prevent their becoming untied.
- (6) Inspection. All ropes shall be inspected before used.
- (7) Defective rope. Rope badly frayed, rotted, exposed to the action of acid or caustic, or otherwise defective and unsafe, shall be condemned and destroyed to avoid all possibility of future use by mistake.

[Order 73-5, § 296-24-29403, filed 5/9/73 and Order 73-4, § 296-24-29403, filed 5/7/73.]

WAC 296-24-29405 Hemp and wire rope slings.

- (1) Inspection. All rope slings shall be inspected thoroughly and regularly at intervals of not more than one month, and when not in use, shall be stored in a dry place.
- (2) Pads. Rope slings shall be protected with pads or blocks when wrapped around sharp edges of structural shapes, casting, etc.
- (3) Slip-noose. Slings shall not be used in single strand slip-noose form.
- (4) Acids. Hemp rope shall not be used as slings for handling objects contaminated with acid.

WAC 296-24-29405 (Cont.)

- (5) How attached. Hand-ropes (guide-ropes) shall not be attached to slings but to hoisting tackle, or (only when necessary) attached to the object handled.
- (6) Strength. All slings shall be of sufficient strength for handling the imposed loads. See tables given for hemp and wire ropes.
- (7) Double slings. Double slings shall be used on all horizontal loads over twelve feet in length, and the distance between the points where slings are attached shall be sufficient to prevent the load from tipping up endwise.
- (8) Spreaders. Spreaders shall be used where there is a danger of sling ends or “hitches” slipping together.
- (9) Defective-Destroyed. Defective and unsafe slings shall be destroyed in order to avoid possibility of their being used by mistake.

[Order 73-5, § 296-24-29405, filed 5/9/73 and Order 73-4, § 296-24-29405, filed 5/7/73.]

WAC 296-24-29407 Guys. Guy wires and ropes shall be of sufficient strength to carry the load imposed upon them and shall be securely fastened in place.

[Order 73-5, § 296-24-29407, filed 5/9/73 and Order 73-4, § 296-24-29407, filed 5/7/73.]

WAC 296-24-29409 Thimbles. Wherever rope is permanently fastened by a single wrap to a metal object less in diameter or shortest measurement than three times the diameter of the rope, a galvanized thimble (of size intended for the rope) shall be inserted between the object and the loop of the rope.

[Order 73-5, § 296-24-29409, filed 5/9/73 and Order 73-4, § 296-24-29409, filed 5/7/73.]

WAC 296-24-29411 Blocks and falls. Blocks and falls shall be carefully inspected before being used. Blocks shall be of substantial construction and maintained in good condition while in use. Blocks shall fit the sizes of ropes they carry and shall not chafe or abrade the ropes running through them.

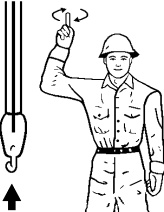

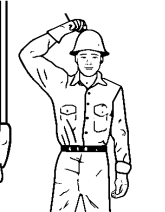
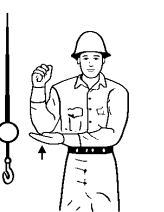
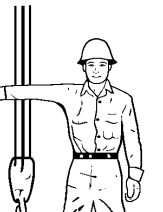
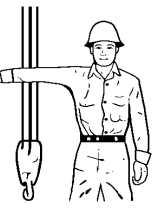
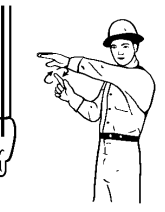
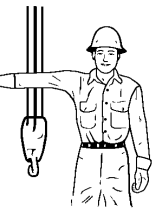
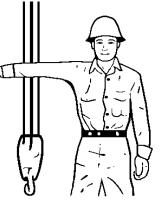
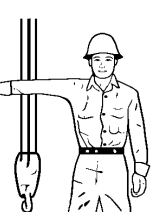
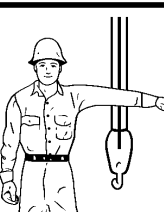
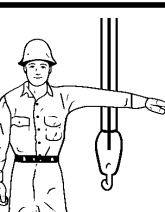
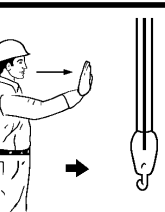
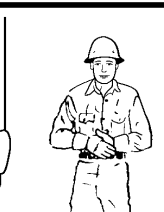
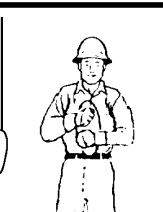

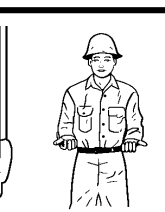
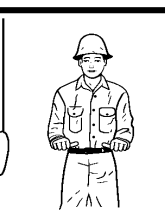
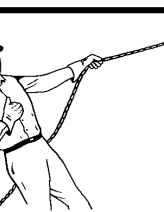
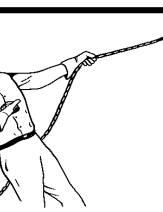
[Order 73-5, § 296-24-29411, filed 5/9/73 and Order 73-4, § 296-24-29411, filed 5/7/73.]

WAC 296-24-29413 Chains and cables.

- (1) If at any time any three foot length of chain is found to have stretched one-third the length of a link it shall be discarded.
- (2) The practice of placing bolts or nails between two links to shorten chains is prohibited
- (3) Splicing broken chains by inserting a bolt between two links with the heads of the bolt and the nut sustaining the load, or passing one link through another and inserting a bolt or nail to hold it, is prohibited.
- (4) Wherever annealing of chains is attempted, it shall be done in properly equipped annealing furnaces and under the direct supervision of a competent person thoroughly versed in heat treating.
- (5) Cables shall be periodically inspected. A copy of the report of the inspections of each running cable shall be filed in a place readily accessible to the department, or authorized representative.

WAC 296-24-29413 (Cont.)

**STANDARD HAND SIGNALS FOR CRANES,
CRAWLER, LOCOMOTIVE, AND TRUCK CRANES**

 <p>HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.</p>	 <p>LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circles.</p>	 <p>USE MAIN HOIST. Tap fist on head; then use regular signals</p>	 <p>USE WHIPLINE. (Auxiliary Hoist). Tap elbow with one hand; then use regular signals.</p>	 <p>RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.</p>
 <p>LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.</p>	 <p>MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example.)</p>	 <p>RAISE THE BOOM AND LOWER THE LOAD. With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.</p>	 <p>LOWER THE BOOM AND RAISE THE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.</p>	 <p>SWING. Arm extended, point with finger in direction of swing of boom.</p>
 <p>STOP. Arm extended, palm down, hold position rigidly.</p>	 <p>EMERGENCY STOP. Arm extended, palm down, move hand rapidly right and left.</p>	 <p>TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.</p>	 <p>DOG EVERYTHING. Clasp hands in front of body.</p>	 <p>TRAVEL (Both Tracks). Use both fists in front of body, making a circular motion about each other, indicating direction of travel; forward or backward. (For crawler cranes only.)</p>
 <p>TRAVEL (One Track). Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For crawler cranes only.)</p>	 <p>EXTEND BOOM (Telescoping Booms). Both fists in front of body with thumbs pointing outward.</p>	 <p>RETRACT BOOM (Telescoping Booms). Both fists in front of body with thumbs pointing toward each other.</p>	 <p>EXTEND BOOM (Telescoping Boom). One Hand Signal. One fist in front of chest with thumb tapping chest.</p>	 <p>RETRACT BOOM (Telescoping Boom). One Hand Signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.</p>

WAC 296-24-29413 (Cont.)

1. Do not remove the load or the crane unless you understand the floor signal clearly.
2. Be careful that the load does not swing to injure your hook-on man/woman or other floorpersons; make certain they are in the clear.
3. When raising or lowering the load, see that it will safely clear adjacent stockpiles or machinery.
4. Never pick up a load greater than the capacity of your crane. In case of doubt, call your foreperson.
5. Never do ANYTHING that is not safe.
6. Co-operate with your hook-on or floorperson. You and he/she are a team handling a valuable piece of equipment-Never let it become a hazard.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-17-015 (Order 80-21), § 296-24-29413, filed 11/13/80; Order 73-5, § 296-24-29413, filed 5/9/73 and Order 73-4, § 296-24-29413, filed 5/7/73.]

WAC 296-24-29415 Slings. This section applies to slings used in conjunction with other material handling equipment for the movement of material by hoisting, in employments covered by this chapter. The types of slings covered are those made from alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope (conventional three strand construction), and synthetic web (nylon, polyester, and polypropylene).

[Order 76-6, § 296-24-29415, filed 3/1/76.]

WAC 296-24-29417 Definitions.

- (1) **Angle of loading.** Means the inclination of a leg or branch of a sling measured from the horizontal or vertical plane as shown in Fig. D-5: *Provided*, That an angle of loading of five degrees or less from the vertical may be considered a vertical angle of loading.
- (2) **Basket hitch.** Means a sling configuration whereby the sling is passed under the load and has both ends, end attachments, eyes or handles on the hook or a single master link.
- (3) **Braided wire rope.** Means a wire rope formed by plaiting component wire ropes.
- (4) **Bridle wire rope sling.** Means a sling composed of multiple wire rope legs with the top ends gathered in a fitting that goes over the lifting hook.
- (5) **Cable laid endless sling-mechanical joint.** Means a wire rope sling made endless by joining the ends of a single length of cable laid rope with one or more metallic fittings.
- (6) **Cable laid grommet-hand tucked.** Means an endless wire rope sling made from one length of rope wrapped six times around a core formed by hand tucking the ends of the rope inside the six wraps.
- (7) **Cable laid rope.** Means a wire rope composed of six wire ropes wrapped around a fiber or wire rope core.
- (8) **Cable laid rope sling-mechanical joint.** Means a wire rope sling made from a cable laid rope with eyes fabricated by pressing or swagging one or more metal sleeves over the rope junction.
- (9) **Choker hitch.** Means a sling configuration with one end of the sling passing under the load and through an end attachment, handle or eye on the other end of the sling.

WAC 296-24-29417 (Cont.)

- (10) **Coating.** Means an elastomer or other suitable material applied to a sling or to a sling component to impart desirable properties.
- (11) **Cross rod.** Means a wire used to join spirals of metal mesh to form a complete fabric. (See Fig. D-2.)
- (12) **Designated.** Means selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.
- (13) **Equivalent entity.** Means a person or organization (including an employer) which, by possession of equipment, technical knowledge and skills, can perform with equal competence the same repairs and tests as the person or organization with which it is equated.
- (14) **Fabric (metal mesh).** Means the flexible portion of a metal mesh sling consisting of a series of transverse coils and cross rods.
- (15) **Female handle (choker).** Means a handle with a handle eye and a slot of such dimension as to permit passage of a male handle thereby allowing the use of a metal mesh sling in a choker hitch. (See Fig. D-1.)
- (16) **Handle.** Means a terminal fitting to which metal mesh fabric is attached. (See Fig. D-1.)
- (17) **Handle eye.** Means an opening in a handle of a metal mesh sling shaped to accept a hook, shackle or other lifting device. (See Fig. D-1.)
- (18) **Hitch.** Means a sling configuration whereby the sling is fastened to an object or load, either directly to it or around it.
- (19) **Link.** Means a single ring of a chain.
- (20) **Male handle (triangle).** Means a handle with a handle eye.
- (21) **Master coupling link.** Means an alloy steel welded coupling link used as an intermediate link to join alloy steel chain to master links. (See Fig. D-3.)
- (22) **Master link or gathering ring.** Means a forged or welded steel link used to support all members (legs) of an alloy steel chain sling or wire rope sling. (See Fig. D-3.)
- (23) **Mechanical coupling link.** Means a nonwelded, mechanically closed steel link used to attach master links, hooks, etc., to alloy steel chain.
- (24) **Proof load.** Means the load applied in performance of a proof test.
- (25) **Proof test.** Means a nondestructive tension test performed by the sling manufacturer or an equivalent entity to verify construction and workmanship of a sling.
- (26) **Rated capacity or working load limit.** Means the maximum working load permitted by the provisions of this section.
- (27) **Reach.** Means the effective length of an alloy steel chain sling measured from the top bearing surface of the upper terminal component to the bottom bearing surface of the lower terminal component.

WAC 296-24-29417 (Cont.)

- (28) **Selvage edge.** Means the finished edge of synthetic webbing designed to prevent unraveling.
- (29) **Sling.** Means an assembly which connects the load to the material handling equipment.
- (30) **Sling manufacturer.** Means a person or organization that assembles sling components into their final form for sale to users.
- (31) **Spiral.** Means a single transverse coil that is the basic element from which metal mesh is fabricated. (See Fig. D-2.)
- (32) **Strand laid endless sling-mechanical joint.** Means a wire rope sling made endless from one length of rope with the ends joined by one or more metallic fittings.
- (33) **Strand laid grommet-hand tucked.** Means an endless wire rope sling made from one length of strand wrapped six times around a core formed by hand tucking the ends of the strand inside the six wraps.
- (34) **Strand laid rope.** Means a wire rope made with strands (usually six or eight) wrapped around a fiber core, wire strand core, or independent wire rope core (IWRC).
- (35) **Vertical hitch.** Means a method of supporting a load by a single, vertical part or leg of the sling. (See Fig. D-4.)

[Order 76-6, § 296-24-29417, filed 3/1/76.]

WAC 296-24-29419 Safe operating practices. Whenever any sling is used, the following practices shall be observed:

- (1) Slings that are damaged or defective shall not be used.
- (2) Slings shall not be shortened with knots or bolts or other makeshift devices.
- (3) Sling legs shall not be kinked.
- (4) Slings shall not be loaded in excess of their rated capacities.
- (5) Slings used in a basket hitch shall have the loads balanced to prevent slippage.
- (6) Slings shall be securely attached to their loads.
- (7) Slings shall be padded or protected from the sharp edges of their loads.
- (8) Suspended loads shall be kept clear of all obstructions.
- (9) All employees shall be kept clear of loads about to be lifted and of suspended loads.
- (10) Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.
- (11) Shock loading is prohibited.
- (12) A sling shall not be pulled from under a load when the load is resting on the sling.

[Order 76-6, § 296-24-29419, filed 3/1/76.]

WAC 296-24-29421 Inspections. Each day before being used, the sling and all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed during sling use, where service conditions warrant. Damaged or defective slings shall be immediately removed from service.

[Order 76-6, § 296-24-29421, filed 3/1/76.]

WAC 296-24-29423 Alloy steel chain slings.

- (1) Sling identification. Alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity and reach.
- (2) Attachments.
 - (a) Hooks, rings, oblong links, pear shaped links, welded or mechanical coupling links or other attachments shall have a rated capacity at least equal to that of the alloy steel chain with which they are used or the sling shall not be used in excess of the rated capacity of the weakest component.
 - (b) Makeshift links or fasteners formed from bolts or rods, or other such attachments, shall not be used.
- (3) Inspections.
 - (a) In addition to the inspection required by WAC 296-24-29421, a thorough periodic inspection of alloy steel chain slings in use shall be made on a regular basis, to be determined on the basis of:
 - (i) Frequency of sling use;
 - (ii) Severity of service conditions;
 - (iii) Nature of lifts being made; and
 - (iv) Experience gained on the service life of slings used in similar circumstances. Such inspections shall in no event be at intervals greater than once every 12 months.
 - (b) The employer shall make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected, and shall make such record available for examination.
 - (c) The thorough inspection of alloy steel chain slings shall be performed by a competent person designated by the employer, and shall include a thorough inspection for wear, defective welds, deformation and increase in length. Where such defects or deterioration are present, the sling shall be immediately removed from service.
- (4) Proof testing. The employer shall ensure that before use, each new, repaired, or reconditioned alloy steel chain sling, including all welded components in the sling assembly, shall be proof tested by the sling manufacturer or equivalent entity, in accordance with paragraph 5.2 of the American Society of Testing and Materials Specification A391-65 (ANSI G61.1-1968). The employer shall retain a certificate of the proof test and shall make it available for examination.
- (5) Sling use. Alloy steel chain slings shall not be used with loads in excess of the rated capacities prescribed in Table D-1. Slings not included in this table shall be used only in accordance with the manufacturer's recommendations.

WAC 296-24-29423 (Cont.)

- (6) Safe operating temperatures. Alloy steel chain slings shall be permanently removed from service if they are heated above 1000°F. When exposed to service temperatures in excess of 600°F maximum working load limits permitted in Table D-1 shall be reduced in accordance with the chain or sling manufacturer's recommendations.
- (7) Repairing and reconditioning alloy steel chain slings.
 - (a) Worn or damaged alloy steel chain slings or attachments shall not be used until repaired. When welding or heat testing is performed, slings shall not be used unless repaired, reconditioned and proof tested by the sling manufacturer or an equivalent entity.
 - (b) Mechanical coupling links or low carbon steel repair links shall not be used to repair broken lengths of chain.
- (8) Effects of wear. If the chain size at any point of any links is less than that stated in Table D-2, the sling shall be removed from service.
- (9) Deformed attachments.
 - (a) Alloy steel chain sling with cracked or deformed master links, coupling links or other components shall be removed from service.
 - (b) Slings shall be removed from service if hooks are cracked, have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.

[Order 76-29, § 296-24-29423, filed 9/30/76; Order 76-6, § 296-24-29423, filed 3/1/76.]

WAC 296-24-29425 Wire rope slings.

- (1) Sling use. Wire rope slings shall not be used with loads in excess of the rated capacities shown in Tables D-3 through D-14. Slings not included in these tables shall be used only in accordance with the manufacturer's recommendations.
- (2) Minimum sling lengths.
 - (a) Cable laid and 6x19 and 6x37 slings shall have a minimum clear length of wire rope 10 times the component rope diameter between splices, sleeves or end fittings.
 - (b) Braided slings shall have a minimum clear length of wire rope 40 times the component rope diameter between the loops or end fittings.
 - (c) Cable laid grommets, strand laid grommets and endless slings shall have a minimum circumferential length of 96 times their body diameter.
- (3) Safe operating temperatures. Fiber core wire rope slings of all grades shall be permanently removed from service if they are exposed to temperatures in excess of 200°F. When nonfiber core wire rope slings of any grade are used at temperatures above 400°F or below minus 60°F, recommendations of the sling manufacturer regarding use at that temperature shall be followed.
- (4) End attachments.

WAC 296-24-29425 (Cont.)

- (a) Welding of end attachments, except covers to thimbles, shall be performed prior to the assembly of the sling.
 - (b) All welded end attachments shall not be used unless proof tested by the manufacturer or equivalent entity at twice their rated capacity prior to initial use. The employer shall retain a certificate of the proof test, and make it available for examination.
- (5) Removal from service. Wire rope slings shall be immediately removed from service if any of the following conditions are present:
- (a) Ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.
 - (b) Wear or scraping of one-third the original diameter of outside individual wires.
 - (c) Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure.
 - (d) Evidence of heat damage.
 - (e) End attachments that are cracked, deformed or worn.
 - (f) Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.
 - (g) Corrosion of the rope or end attachments.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-29425, filed 7/31/79; Order 76-6, § 296-24-29425, filed 3/1/76.]

WAC 296-24-29427 Metal mesh slings.

- (1) Sling marking. Each metal mesh sling shall have permanently affixed to it a durable marking that states the rated capacity for vertical basket hitch and choker hitch loadings.
- (2) Handles. Handles shall have a rated capacity at least equal to the metal fabric and exhibit no deformation after proof testing.
- (3) Attachments of handles to fabric. The fabric and handles shall be joined so that:
 - (a) The rated capacity of the sling is not reduced.
 - (b) The load is evenly distributed across the width of the fabric.
 - (c) Sharp edges will not damage the fabric.
- (4) Sling coatings. Coatings which diminish the rated capacity of a sling shall not be applied.
- (5) Sling testing. All new and repaired metal mesh slings, including handles, shall not be used unless proof tested by the manufacturer or equivalent entity at a minimum of 1-1/2 times their rated capacity. Elastomer impregnated slings shall be proof tested before coating.

WAC 296-24-29427 (Cont.)

- (6) Proper use of metal mesh slings. Metal mesh slings shall not be used to lift loads in excess of their rated capacities as prescribed in Table D-15. Slings not included in this table shall be used only in accordance with the manufacturer's recommendations.
- (7) Safe operating temperatures. Metal mesh slings which are not impregnated with elastomers may be used in a temperature range from minus 20°F to plus 550°F without decreasing the working load limit. Metal mesh slings impregnated with polyvinyl chloride or neoprene may be used only in a temperature range from zero degrees to plus 200°F. For operations outside these temperature ranges or for metal mesh slings impregnated with other materials, the sling manufacturer's recommendations shall be followed.
- (8) Repairs.
 - (a) Metal mesh slings which are repaired shall not be used unless repaired by a metal mesh sling manufacturer or an equivalent entity.
 - (b) Once repaired, each sling shall be permanently marked or tagged, or a written record maintained, to indicate the date and nature of the repairs and the person or organization that performed the repairs. Records of repairs shall be made available for examination.
- (9) Removal from service. Metal mesh slings shall be immediately removed from service if any of the following conditions are present:
 - (a) A broken weld or broken brazed joint along the sling edge.
 - (b) Reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion.
 - (c) Lack of flexibility due to distortion of the fabric.
 - (d) Distortion of the female handle so that the depth of the slot is increased more than 10 percent.
 - (e) Distortion of either handle so that the width of the eye is decreased more than 10 percent.
 - (f) A 15 percent reduction of the original cross sectional area of metal at any point around the handle eye.
 - (g) Distortion of either handle out of its plane.

[Order 76-6, § 296-24-29427, filed 3/1/76.]

WAC 296-24-29429 Natural and synthetic fiber rope slings.

- (1) Sling use.
 - (a) Fiber rope slings made from conventional three strand construction fiber rope shall not be used with loads in excess of the rated capacities prescribed in Tables D-16 through D-19.
 - (b) Fiber rope slings shall have a diameter of curvature meeting at least the minimums specified in Figs. D-4 and D-5.
 - (c) Slings not included in these tables shall be used only in accordance with the manufacturer's recommendations.

WAC 296-24-29429 (Cont.)

- (2) Safe operating temperatures. Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20°F to plus 180°F without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, the sling manufacturer's recommendations shall be followed.
- (3) Splicing. Spliced fiber rope slings shall not be used unless they have been spliced in accordance with the following minimum requirements and in accordance with any additional recommendations of the manufacturer:
 - (a) In manila rope, eye splices shall consist of at least three full tucks, and short splices shall consist of at least six full tucks, three on each side of the splice center line.
 - (b) In synthetic fiber rope, eye splices shall consist of at least four full tucks, and short splices shall consist of at least eight full tucks, four on each side of the center line.
 - (c) Strand end tails shall not be trimmed flush with the surface of the rope immediately adjacent to the full tucks. This applies to all types of fiber rope and both eye and short splices. For fiber rope under one inch in diameter, the tail shall project at least six rope diameters beyond the last full tuck. For fiber rope one inch in diameter and larger, the tail shall project at least six inches beyond the last full tuck. Where a projecting tail interferes with the use of the sling, the tail shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).
 - (d) Fiber rope slings shall have a minimum clear length of rope between eye splices equal to 10 times the rope diameter.
 - (e) Knots shall not be used in lieu of splices.
 - (f) Clamps not designed specifically for fiber ropes shall not be used for splicing.
 - (g) For all eye splices, the eye shall be of such size to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support.
- (4) End attachments. Fiber rope slings shall not be used if end attachments in contact with the rope have sharp edges or projections.
- (5) Removal from service. Natural and synthetic fiber rope slings shall be immediately removed from service if any of the following conditions are present:
 - (a) Abnormal wear.
 - (b) Powdered fiber between strands.
 - (c) Broken or cut fibers.
 - (d) Variations in the size or roundness of strands.
 - (e) Discoloration or rotting.
 - (f) Distortion of hardware in the sling.

WAC 296-24-29429 (Cont.)

- (6) Repairs. Only fiber rope slings made from new rope shall be used. Use of repaired or reconditioned fiber rope slings is prohibited.

[Order 76-6, § 296-24-29429, filed 3/1/76.]

WAC 296-24-29431 Synthetic web slings.

- (1) Sling identification. Each sling shall be marked or coded to show the rated capacities for each type of hitch and type of synthetic web material.
- (2) Webbing. Synthetic webbing shall be of uniform thickness and width and selvage edges shall not be split from the webbing's width.
- (3) Fittings. Fittings shall be:
 - (a) Of a minimum breaking strength equal to that of the sling; and
 - (b) Free of all sharp edges that could in any way damage the webbing.
- (4) Attachment of end fittings to webbing and formation of eyes. Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an even pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.
- (5) Sling use. Synthetic web slings illustrated in Figure D-6 shall not be used with loads in excess of the rated capacities specified in Tables D-20 through D-22. Slings not included in these tables shall be used only in accordance with the manufacturer's recommendations.
- (6) Environmental conditions. When synthetic web slings are used, the following precautions shall be taken:
 - (a) Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquids of acids or phenolics are present.
 - (b) Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.
 - (c) Web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.
- (7) Safe operating temperatures. Synthetic web slings of polyester and nylon shall not be used at temperatures in excess of 180°F. Polypropylene web slings shall not be used at temperatures in excess of 200°F.
- (8) Repairs.
 - (a) Synthetic web slings which are repaired shall not be used unless repaired by a sling manufacturer or an equivalent entity.
 - (b) Each repaired sling shall be proof tested by the manufacturer or equivalent entity to twice the rated capacity prior to its return to service. The employer shall retain a certificate of the proof test and make it available for examination.
 - (c) Slings, including webbing and fittings, which have been repaired in a temporary manner shall not be used.

WAC 296-24-29431 (Cont.)

- (9) Removal from service. Synthetic web slings shall be immediately removed from service if any of the following conditions are present:
- (a) Acid or caustic burns;
 - (b) Melting or charring of any part of the sling surface;
 - (c) Snags, punctures, tears or cuts;
 - (d) Broken or worn stitches; or
 - (e) Distortion of fittings.

WAC 296-24-29431 (Cont.)

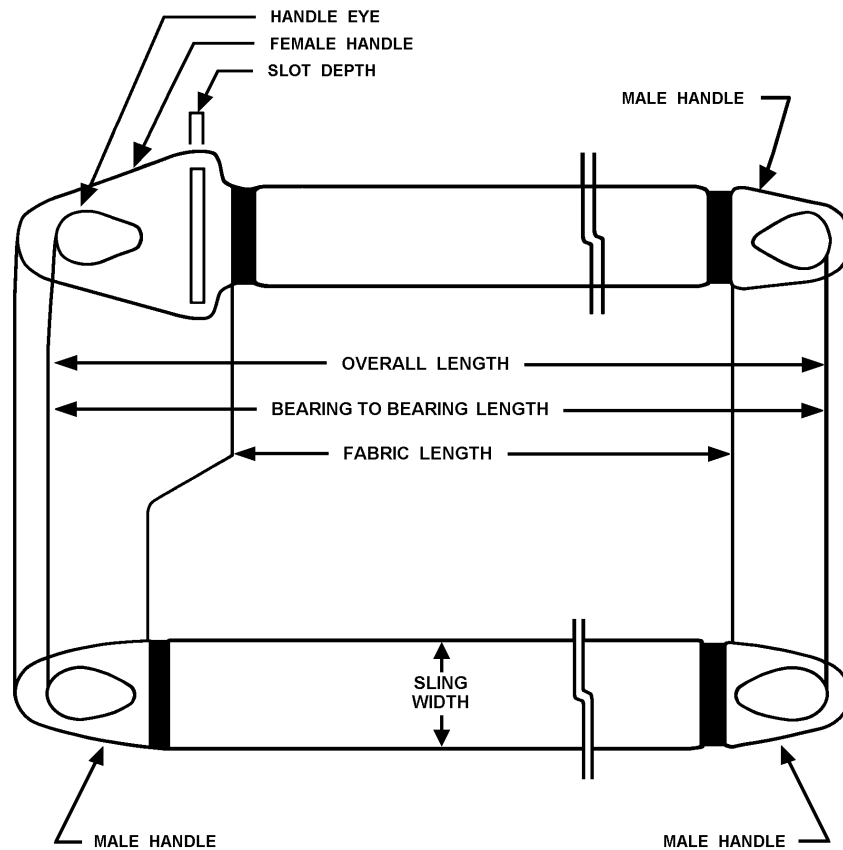


FIGURE D-1
Metal Mesh Sling (Typical)

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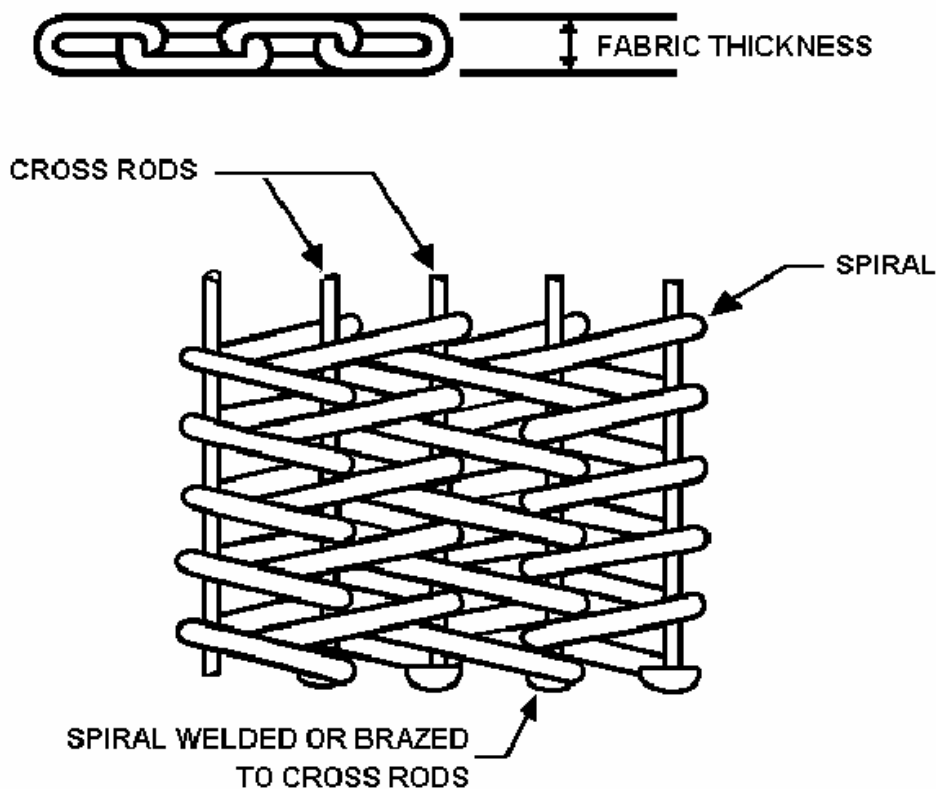


FIGURE D-2
Metal Mesh Construction

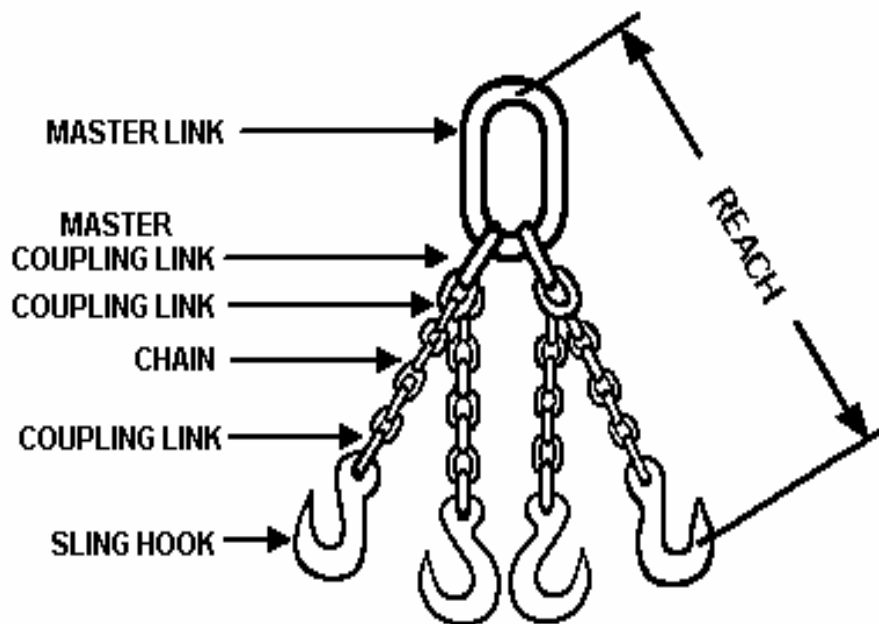


FIGURE D-3
Major Components of a Quadruple Sling

WAC 296-24-29431 (Cont.)

TABLE D-1
RATED CAPACITY (WORKING LOAD LIMIT), FOR ALLOY STEEL CHAIN SLINGS* RATED CAPACITY
(WORKING LOAD LIMIT), POUNDS

TABLE D-1: Part 1--Double Slings

Chain Size, Inches	Single 30 Sling 90 degree loading	30 degree 60 degree	Double Sling Vertical Angle ¹ 45 degree Horizontal Angle ² 45 degree	60 degree 30 degree
1/4	3,250	5,650	4,550	3,250
3/8	6,600	11,400	9,300	6,600
1/2	11,250	19,500	15,900	11,250
5/8	16,500	28,500	23,300	16,500
3/4	23,000	39,800	32,500	23,000
7/8	28,750	49,800	40,600	28,750
1	38,750	67,100	54,800	38,750
1 1/8	44,500	77,000	63,000	44,500
1 1/4	57,500	99,500	81,000	57,500
1 3/8	67,000	116,000	94,000	67,000
1 1/2	80,000	138,000	112,500	80,000
1 3/4	100,000	172,000	140,000	100,000

¹ Rating of multileg slings adjusted for angle of loading measured as the included angle between the inclined leg and the vertical as shown in Figure D-5

² Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load, as shown in Figure D-5.

³ Quadruple sling rating is same as triple sling because normal lifting practice may not distribute load uniformly to all 4 legs.

TABLE D-1: Part 2--Triple and Quadruple Slings

Chain Size, Inches	Single Branch Sling 90 degree loading	30 degree 60 degree	Triple and Quadruple Slings ³ Vertical Angle ¹ 45 degree Horizontal Angle ² 45 degree	60 degree 30 degree
1/4	3,250	8,400	6,800	4,900
3/8	6,600	17,000	14,000	9,900
1/2	11,250	29,000	24,000	17,000
5/8	16,500	43,000	35,000	24,500
3/4	23,000	59,500	48,500	34,500
7/8	28,750	74,500	61,000	43,000
1	38,750	101,000	82,000	58,000
1 1/8	44,500	115,500	94,500	66,500
1 1/4	57,500	149,000	121,500	86,000
1 3/8	67,000	174,000	141,000	100,500
1 1/2	80,000	207,000	169,000	119,500
1 3/4	100,000	258,000	210,000	150,000

¹ Rating of multileg slings adjusted for angle of loading measured as the included angle between the inclined leg and the vertical as shown in Figure D-5.

² Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load, as shown in Figure D-5.

³ Quadruple sling rating is same as triple sling because normal lifting practice may not distribute load uniformly to all 4 legs.

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TABLE D-2
MINIMUM ALLOWABLE CHAIN SIZE
AT ANY POINT OF LINK

Chain Size, Inches	Minimum Allowable Chain Size, Inches
1/4	13/64
3/8	19/64
1/2	25/64
5/8	31/64
3/4	19/32
7/8	45/64
1	13/16
1 1/8	29/32
1 1/4	1
1 3/8	1 3/32
1 1/2	1 3/16
1 3/4	1 13/32

TABLE D-3
RATED CAPACITIES FOR SINGLE LEG SLINGS 6x19 AND 6x37
CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE WITH FIBER CORE (FC)

Rope		Rated Capacities, Tons (2,000 lb)								
Dia. (Inches)	Constr.	Vertical			Choker			Vertical Basket *		
		HT	MS	S	HT	MS	S	HT	MS	S
1/4	6x19	0.49	0.51	0.55	0.37	0.38	0.41	0.99	1.0	1.1
5/16	6x19	0.76	0.79	0.85	0.57	0.59	0.64	1.5	1.6	1.7
3/8	6x19	1.1	1.1	1.2	0.80	0.85	0.91	2.1	2.2	2.4
7/16	6x19	1.4	1.5	1.6	1.1	1.1	1.2	2.9	3.0	3.3
1/2	6x19	1.8	2.0	2.1	1.4	1.5	1.6	3.7	3.9	4.3
9/16	6x19	2.3	2.5	2.7	1.7	1.9	2.0	4.6	5.0	5.4
5/8	6x19	2.8	3.1	3.3	2.1	2.3	2.5	5.6	6.2	6.7
3/4	6x19	3.9	4.4	4.8	2.9	3.3	3.6	7.8	8.8	9.5
7/8	6x19	5.1	5.9	6.4	3.9	4.5	4.8	10.0	12.0	13.0
1	6x19	6.7	7.7	8.4	5.0	5.8	6.3	13.0	15.0	17.0
1 1/8	6x19	8.4	9.5	10.0	6.3	7.1	7.9	17.0	19.0	21.0
1 1/4	6x37	9.8	11.0	12.0	7.4	8.3	9.2	20.0	22.0	25.0
1 3/8	6x37	12.0	13.0	15.0	8.9	10.0	11.0	24.0	27.0	30.0
1 1/2	6x37	14.0	16.0	17.0	10.0	12.0	13.0	28.0	32.0	35.0
1 5/8	6x37	16.0	18.0	21.0	12.0	14.0	15.0	33.0	37.0	41.0
1 3/4	6x37	19.0	21.0	24.0	14.0	16.0	18.0	38.0	43.0	48.0
2	6x37	25.0	28.0	31.0	18.0	21.0	23.0	49.0	55.0	62.0

HT = Hand tucked splice and hidden tuck splice.
For hidden tuck splice (IWRC) use value in HT columns.

MS = Mechanical splice.

S = Swaged or zinc poured socket.

* These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where:

D = Diameter of curvature around which the body of the sling is bent.

d = Diameter of rope.

WAC 296-24-29431 (Cont.)

TABLE D-4
RATED CAPACITIES FOR SINGLE LEG SLINGS 6x19 AND 6x37
CLASSIFICATION IMPROVED FLOW STEEL GRADE ROPE WITH INDEPENDENT WIRE ROPE CORE (IWRC)

Rope		Rated Capacities, Tons (2,000 lb)								
Dia. (Inches)	Constr.	Vertical			Choker			Vertical Basket *		
		HT	MS	S	HT	MS	S	HT	MS	S
1/4	6x19	0.53	0.56	0.59	0.40	0.42	0.44	1.0	1.1	1.2
5/16	6x19	0.81	0.87	0.92	0.61	0.65	0.69	1.6	1.7	1.8
3/8	6x19	1.1	1.2	1.3	0.86	0.93	0.98	2.3	2.5	2.6
7/16	6x19	1.5	1.7	1.8	1.2	1.3	1.3	3.1	3.4	3.5
1/2	6x19	2.0	2.2	2.3	1.5	1.6	1.7	3.9	4.4	4.6
9/16	6x19	2.5	2.7	2.9	1.8	2.1	2.2	4.9	5.5	5.8
5/8	6x19	3.0	3.4	3.6	2.2	2.5	2.7	6.0	6.8	7.2
3/4	6x19	4.2	4.9	5.1	3.1	3.6	3.8	8.4	9.7	10.0
7/8	6x19	5.5	6.6	6.9	4.1	4.9	5.2	11.0	13.0	14.0
1	6x19	7.2	8.5	9.0	5.4	6.4	6.7	14.0	17.0	18.0
1 1/8	6x19	9.0	10.0	11.0	6.8	7.8	8.5	18.0	21.0	23.0
1 1/4	6x37	10.0	12.0	13.0	7.9	9.2	9.9	21.0	24.0	26.0
1 3/8	6x37	13.0	15.0	16.0	9.6	11.0	12.0	25.0	29.0	32.0
1 1/2	6x37	15.0	17.0	19.0	11.0	13.0	14.0	30.0	35.0	38.0
1 5/8	6x37	18.0	20.0	22.0	13.0	15.0	17.0	35.0	41.0	44.0
1 3/4	6x37	20.0	24.0	26.0	15.0	18.0	19.0	41.0	47.0	51.0
2	6x37	26.0	30.0	33.0	20.0	23.0	25.0	53.0	61.0	66.0

HT = Hand tucked splice .

For hidden tuck splice (IWRC) use Table 1 value in HT columns.

MS = Mechanical splice.

S = Swaged or zinc poured socket.

* These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where:

D = Diameter of curvature around which the body of the sling is bent.

d = Diameter of rope.

WAC 296-24-29431 (Cont.)

TABLE D-5
RATED CAPACITIES FOR SINGLE LEG SLINGS CABLE LAID ROPE - MECHANICAL SPLICE ONLY
7x7x7 AND 7x7x19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE 7x6x19 IWRC
CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

Rope		Rated Capacities, Tons (2,000 lb)		
Dia. Inches	Constr.	Vertical	Choker	Vertical Basket*
1/4	7x7x7	0.50	0.38	1.0
3/8	7x7x7	1.1	0.81	2.0
1/2	7x7x7	1.8	1.4	3.7
5/8	7x7x7	2.8	2.1	5.5
3/4	7x7x7	3.8	2.9	7.6
5/8	7x7x19	2.9	2.2	5.8
3/4	7x7x19	4.1	3.0	8.1
7/8	7x7x19	5.4	4.0	11.0
1	7x7x19	6.9	5.1	14.0
1 1/8	7x7x19	8.2	6.2	16.0
1 1/4	7x7x19	9.9	7.4	20.0
3/4	7x6x19 IWRC	3.8	2.8	7.6
7/8	7x6x19 IWRC	5.0	3.8	10.0
1	7x6x19 IWRC	6.4	4.8	13.0
1 1/8	7x6x19 IWRC	7.7	5.8	15.0
1 1/4	7x6x19 IWRC	9.2	6.9	18.0
1 5/16	7x6x19 IWRC	10.0	7.5	20.0
1 3/8	7x6x19 IWRC	11.0	8.2	22.0
1 1/2	7x6x19 IWRC	13.0	9.6	26.0

* These values only apply when the D/d ratio is 10 or greater where:

D = Diameter of curvature around which the body of the sling is bent.

d = Diameter of rope.

WAC 296-24-29431 (Cont.)

TABLE D-6
RATED CAPACITIES FOR SINGLE LEG SLINGS 8-PART AND 6-PART BRAIDED ROPE
6x7 AND 6x19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE 7x7
CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Component Ropes		Rated Capacities, Tons (2,000 lb)					
		Vertical		Choker		Vertical Basket to 30 degrees*	
Diameter (Inches)	Constr.	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6x7	0.42	0.32	0.32	0.24	0.74	0.55
1/8	6x7	0.76	0.57	0.57	0.42	1.3	0.98
13/16	6x7	1.7	1.3	1.3	0.94	2.9	2.2
3/32	7x7	0.51	0.39	0.38	0.29	0.89	0.67
1/8	7x7	0.95	0.71	0.71	0.53	1.6	1.2
3/16	7x7	2.1	1.5	1.5	1.2	3.6	2.7
3/16	6x19	1.7	1.3	1.3	0.98	3.0	2.2
1/4	6x19	3.1	2.3	2.3	1.7	5.3	4.0
5/16	6x19	4.8	3.6	3.6	2.7	8.3	6.2
3/8	6x19	6.8	5.1	5.1	3.8	12.0	8.9
7/16	6x19	9.3	6.9	6.9	5.2	16.0	12.0
1/2	6x19	12.0	9.0	9.0	6.7	21.0	15.0
9/16	6x19	15.0	11.0	11.0	8.5	26.0	20.0
5/8	6x19	19.0	14.0	14.0	10.0	32.0	24.0
3/4	6x19	27.0	20.0	20.0	15.0	46.0	35.0
7/8	6x19	36.0	27.0	27.0	20.0	62.0	47.0
1	6x19	47.0	35.0	35.0	26.0	81.0	61.0

* These values only apply when D/d ratio is 20 or greater where:

D = Diameter of curvature around which the body of the sling is bent.

d = Diameter of component rope.

WAC 296-24-29431 (Cont.)

TABLE D-7
RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS 6x19 AND 6x37
CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE WITH FIBER CORE (FC)

TABLE D-7: Part 1-2--Leg Bridle Slings

Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree		45 degree angle		Vert 60 degree Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1/4	6x19	0.85	0.88	0.70	0.72	0.49	0.51
5/16	6x19	1.3	1.4	1.1	1.1	0.76	0.79
3/8	6x19	1.8	1.9	1.5	1.6	1.1	1.1
7/16	6x19	2.5	2.6	2.0	2.2	1.4	1.5
1/2	6x19	3.2	3.4	2.6	2.8	1.8	2.0
9/16	6x19	4.0	4.3	3.2	3.5	2.3	2.5
5/8	6x19	4.8	5.3	4.0	4.4	2.8	3.1
3/4	6x19	6.8	7.6	5.5	6.2	3.9	4.4
7/8	6x19	8.9	10.0	7.3	8.4	5.1	5.9
1	6x19	11.0	13.0	9.4	11.0	6.7	7.7
1 1/8	6x19	14.0	16.0	12.0	13.0	8.4	9.5
1 1/4	6x37	17.0	19.0	14.0	16.0	9.8	11.0
1 3/8	6x37	20.0	23.0	17.0	19.0	12.0	13.0
1 1/2	6x37	24.0	27.0	20.0	22.0	14.0	16.0
1 5/8	6x37	28.0	32.0	23.0	26.0	16.0	18.0
1 3/4	6x37	33.0	37.0	27.0	30.0	19.0	21.0
2	6x37	43.0	48.0	35.0	39.0	25.0	28.0

HT = Hand tucked splice.

MS = Mechanical splice.

TABLE D-7: Part 2-3-Leg Bridle Slings

Rope		Rated Capacities, Tons (2,000 lb)					
		3-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree		45 degree angle		Vert 60 degree Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1/4	6x19	1.3	1.3	1.0	1.1	0.74	0.76
5/16	6x19	2.0	2.0	1.6	1.7	1.1	1.2
3/8	6x19	2.8	2.9	2.3	2.4	1.6	1.7
7/16	6x19	3.7	4.0	3.0	3.2	2.1	2.3
1/2	6x19	4.8	5.1	3.9	4.2	2.8	3.0
9/16	6x19	6.0	6.5	4.9	5.3	3.4	3.7
5/8	6x19	7.3	8.0	5.9	6.5	4.2	4.6
3/4	6x19	10.0	11.0	8.3	9.3	5.8	6.6
7/8	6x19	13.0	15.0	11.0	13.0	7.7	8.9
1	6x19	17.0	20.0	14.0	16.0	10.0	11.0
1 1/8	6x19	22.0	24.0	18.0	20.0	13.0	14.0
1 1/4	6x37	25.0	29.0	21.0	23.0	15.0	17.0
1 3/8	6x37	31.0	35.0	25.0	28.0	18.0	20.0
1 1/2	6x37	36.0	41.0	30.0	33.0	21.0	24.0
1 5/8	6x37	43.0	48.0	35.0	39.0	25.0	28.0
1 3/4	6x37	49.0	56.0	40.0	45.0	28.0	32.0
2	6x37	64.0	72.0	52.0	59.0	37.0	41.0

HT = Hand tucked splice. MS = Mechanical splice.

WAC 296-24-29431 (Cont.)

TABLE D-8
RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS 6x19 AND 6x37
CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE WITH INDEPENDENT
WIRE ROPE CORE (IWRC)

TABLE D-8: Part 1-2-Leg Bridle Slings

Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree		45 degree angle		Vert 60 degree Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1/4	6x19	0.92	0.97	0.75	0.79	0.53	0.56
5/16	6x19	1.4	1.5	1.1	1.2	0.81	0.87
3/8	6x19	2.0	2.1	1.6	1.8	1.1	1.2
7/16	6x19	2.7	2.9	2.2	2.4	1.5	1.7
1/2	6x19	3.4	3.8	2.8	3.1	2.0	2.2
9/16	6x19	4.3	4.8	3.5	3.9	2.5	2.7
5/8	6x19	5.2	5.9	4.2	4.8	3.0	3.4
3/4	6x19	7.3	8.4	5.9	6.9	4.2	4.9
7/8	6x19	9.6	11.0	7.8	9.3	5.5	6.6
1	6x19	12.0	15.0	10.0	12.0	7.2	8.5
1 1/8	6x19	16.0	18.0	13.0	15.0	9.0	10.0
1 1/4	6x37	18.0	21.0	15.0	17.0	10.0	12.0
1 3/8	6x37	22.0	25.0	18.0	21.0	13.0	15.0
1 1/2	6x37	26.0	30.0	21.0	25.0	15.0	17.0
1 5/8	6x37	31.0	35.0	25.0	29.0	18.0	20.0
1 3/4	6x37	35.0	41.0	29.0	33.0	20.0	24.0
2	6x37	46.0	53.0	37.0	43.0	26.0	30.0

HT = Hand tucked splice. MS = Mechanical splice.

TABLE D-8: Part 2-3-Leg Bridle Slings

Rope		Rated Capacities, Tons (2,000 lb)					
		2-3-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree		45 degree angle		Vert 60 degree Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1/4	6x19	1.4	1.4	1.1	1.2	0.79	0.84
5/16	6x19	2.1	2.3	1.7	1.8	1.2	1.3
3/8	6x19	3.0	3.2	2.4	2.6	1.7	1.9
7/16	6x19	4.0	4.4	3.3	3.6	2.3	2.5
1/2	6x19	5.1	5.7	4.2	4.6	3.0	3.3
9/16	6x19	6.4	7.1	5.2	5.8	3.7	4.1
5/8	6x19	7.8	8.8	6.4	7.2	4.5	5.1
3/4	6x19	11.0	13.0	8.9	10.0	6.3	7.3
7/8	6x19	14.0	17.0	12.0	14.0	8.3	9.9
1	6x19	19.0	22.0	15.0	18.0	11.0	13.0
1 1/8	6x19	23.0	27.0	19.0	22.0	13.0	16.0
1 1/4	6x37	27.0	32.0	22.0	26.0	16.0	18.0
1 3/8	6x37	33.0	38.0	27.0	31.0	19.0	22.0
1 1/2	6x37	39.0	45.0	32.0	37.0	23.0	26.0
1 5/8	6x37	46.0	53.0	38.0	43.0	27.0	31.0
1 3/4	6x37	53.0	61.0	43.0	50.0	31.0	35.0
2	6x37	68.0	79.0	56.0	65.0	40.0	46.0

HT = Hand tucked splice. MS = Mechanical Splice.

WAC 296-24-29431 (Cont.)

TABLE D-9
RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS CABLE LAID ROPE
MECHANICAL SPLICE ONLY 7x7x7 AND 7x7x19 CONSTRUCTIONS GALVANIZED
AIRCRAFT GRADE ROPE 7x6x19 IWRC CONSTRUCTION IMPROVED
FLOW STEEL GRADE ROPE

TABLE D-9: Part 1-2-Leg Bridle Slings

Rope		Rated Capacities, Tons (2,000 lb)		
		2-Leg Bridle Slings		
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree	45 degree angle	Vert 60 degree Horz 30 degree
1/4	7x7x7	0.87	0.71	0.50
3/8	7x7x7	1.9	1.5	1.1
1/2	7x7x7	3.2	2.6	1.8
5/8	7x7x7	4.8	3.9	2.8
3/4	7x7x7	6.6	5.4	3.8
5/8	7x7x19	5.0	4.1	2.9
3/4	7x7x19	7.0	5.7	4.1
7/8	7x7x19	9.3	7.6	5.4
1	7x7x19	12.0	9.7	6.9
1 1/8	7x7x19	14.0	12.0	8.2
1 1/4	7x7x19	17.0	14.0	9.9
3/4	7x6x19 IWRC	6.6	5.4	3.8
7/8	7x6x19 IWRC	8.7	7.1	5.0
1	7x6x19 IWRC	11.0	9.0	6.4
1 1/8	7x6x19 IWRC	13.0	11.0	7.7
1 1/4	7x6x19 IWRC	16.0	13.0	9.2
1 5/16	7x6x19 IWRC	17.0	14.0	10.0
1 3/8	7x6x19 IWRC	19.0	15.0	11.0
1 1/2	7x6x19 IWRC	22.0	18.0	13.0

TABLE D-9: Part 2-3-Leg Bridle Slings

Rope		Rated Capacities, Tons (2,000 lb)		
		3-Leg Bridle Slings		
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree	45 degree angle	Vert 60 degree Horz 30 degree
1/4	7x7x7	1.3	1.1	0.75
3/8	7x7x7	2.8	2.3	1.6
1/2	7x7x7	4.8	3.9	2.8
5/8	7x7x7	7.2	5.9	4.2
3/4	7x7x7	9.9	8.1	5.7
5/8	7x7x19	7.5	6.1	4.3
3/4	7x7x19	10.0	8.6	6.1
7/8	7x7x19	14.0	11.0	8.1
1	7x7x19	18.0	14.0	10.0
1 1/8	7x7x19	21.0	17.0	12.0
1 1/4	7x7x19	26.0	21.0	15.0
3/4	7x6x19 IWRC	9.9	8.0	5.7
7/8	7x6x19 IWRC	13.0	11.0	7.5
1	7x6x19 IWRC	17.0	13.0	9.6
1 1/8	7x6x19 IWRC	20.0	16.0	11.0
1 1/4	7x6x19 IWRC	24.0	20.0	14.0
1 5/16	7x6x19 IWRC	26.0	21.0	15.0
1 3/8	7x6x19 IWRC	28.0	23.0	16.0
1 1/2	7x6x19 IWRC	33.0	27.0	19.0

WAC 296-24-29431 (Cont.)

TABLE D-10
RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS 8-PART AND 6-PART BRAIDED ROPE
6x7 AND 6x19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE 7x7 CONSTRUCTION
GALVANIZED AIRCRAFT GRADE ROPE

TABLE D-10: Part 1-2-Leg Bridle Slings




Component Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree		45 degree angle		Vert 60 degree Horz 30 degree	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6x7	0.74	0.55	0.60	0.45	0.42	0.32
1/8	6x7	1.3	0.98	1.1	0.80	0.76	0.57
3/16	6x7	2.9	2.2	2.4	1.8	1.7	1.3
3/32	7x7	0.89	0.67	0.72	0.55	0.51	0.39
1/8	7x7	1.6	1.2	1.3	1.0	0.95	0.71
3/16	7x7	3.6	2.7	2.9	2.2	2.1	1.5
3/16	6x19	3.0	2.2	2.4	1.8	1.7	1.3
1/4	6x19	5.3	4.0	4.3	3.2	3.1	2.3
5/16	6x19	8.3	6.2	6.7	5.0	4.8	3.6
3/8	6x19	12.0	8.9	9.7	7.2	6.8	5.1
7/16	6x19	16.0	12.0	13.0	9.8	9.3	6.9
1/2	6x19	21.0	15.0	17.0	13.0	12.0	9.0
9/16	6x19	26.0	20.0	21.0	16.0	15.0	11.0
5/8	6x19	32.0	24.0	26.0	20.0	19.0	14.0
3/4	6x19	46.0	35.0	38.0	28.0	27.0	20.0
7/8	6x19	62.0	47.0	51.0	38.0	36.0	27.0
1	6x19	81.0	61.0	66.0	50.0	47.0	35.0

TABLE D-10: Part 2-3-Leg Bridle Slings

Component Rope		Rated Capacities, Tons (2,000 lb)					
		3-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree		45 degree angle		Vert 60 degree Horz 30 degree	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6x7	1.1	0.83	0.90	0.68	0.64	0.48
1/8	6x7	2.0	1.5	1.6	1.2	1.1	0.85
3/16	6x7	4.4	3.3	3.6	2.7	2.5	1.9
3/32	7x7	1.3	1.0	1.1	0.82	0.77	0.58
1/8	7x7	2.5	1.8	2.0	1.5	1.4	1.1
3/16	7x7	5.4	4.0	4.4	3.3	3.1	2.3
3/16	6x19	4.5	3.4	3.7	2.8	2.6	1.9
1/4	6x19	8.0	6.0	6.5	4.9	4.6	3.4
5/16	6x19	12.0	9.3	10.0	7.6	7.1	5.4
3/8	6x19	18.0	13.0	14.0	11.0	10.0	7.7
7/16	6x19	24.0	18.0	20.0	15.0	14.0	10.0
1/2	6x19	31.0	23.0	25.0	19.0	18.0	13.0
9/16	6x19	39.0	29.0	32.0	24.0	23.0	17.0
5/8	6x19	48.0	36.0	40.0	30.0	28.0	21.0
3/4	6x19	69.0	52.0	56.0	42.0	40.0	30.0
7/8	6x19	94.0	70.0	76.0	57.0	54.0	40.0
1	6x19	122.0	91.0	99.0	74.0	70.0	53.0

WAC 296-24-29431 (Cont.)

TABLE D-11
RATED CAPACITIES FOR STRAND LAID
GROMMET - HAND TUCKED IMPROVED
PLOW STEEL GRADE ROPE




ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
				
Dia. (Inches)	Constr.	Vertical	Choker	Vertical Basket*
1/4	7x19	0.85	0.64	1.7
5/16	7x19	1.3	1.0	2.6
3/8	7x19	1.9	1.4	3.8
7/16	7x19	2.6	1.9	5.2
1/2	7x19	3.3	2.5	6.7
9/16	7x19	4.2	3.1	8.4
5/8	7x19	5.2	3.9	10.0
3/4	7x19	7.4	5.6	15.0
7/8	7x19	10.0	7.5	20.0
1	7x19	13.0	9.7	26.0
1 1/8	7x19	16.0	12.0	32.0
1 1/4	7x37	18.0	14.0	37.0
1 3/8	7x37	22.0	16.0	44.0
1 1/2	7x37	26.0	19.0	52.0

* These values only apply when the D/d ratio is 5 or greater where:

D = Diameter of curvature around which rope is bent.

d = Diameter of rope body.

TABLE D-12
RATED CAPACITIES FOR CABLE LAID GROMMET - HAND TUCKED 7x6x7 AND 7x6x19
CONSTRUCTIONS IMPROVED PLOW STEEL GRADE ROPE 7x7x7 CONSTRUCTION GALVANIZED
AIRCRAFT GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
				
Dia. (Inches)	Constr.	Vertical	Choker	Vertical Basket*
3/8	7x6x7	1.3	0.95	2.5
9/16	7x6x7	2.8	2.1	5.6
5/8	7x6x7	3.8	2.8	7.6
3/8	7x7x7	1.6	1.2	3.2
9/16	7x7x7	3.5	2.6	6.9
5/8	7x7x7	4.5	3.4	9.0
5/8	7x6x19	3.9	3.0	7.9
3/4	7x6x19	5.1	3.8	10.0
15/16	7x6x19	7.9	5.9	16.0
1 1/8	7x6x19	11.0	8.4	22.0
1 5/16	7x6x19	15.0	11.0	30.0
1 1/2	7x6x19	19.0	14.0	39.0
1 11/16	7x6x19	24.0	18.0	49.0
1 7/8	7x6x19	30.0	22.0	60.0
2 1/4	7x6x19	42.0	31.0	84.0
2 5/8	7x6x19	56.0	42.0	112.0




* These values only apply when the D/d ratio is 5 or greater where:

D = Diameter of curvature around which cable body is bent.

d = Diameter of cable body.

WAC 296-24-29431 (Cont.)

TABLE D-13
RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS - MECHANICAL JOINT
IMPROVED PLOW STEEL GRADE ROPE




ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
				
Dia. (Inches)	Constr.	Vertical	Choker	Vertical Basket*
1/4	6x19 IWRC	0.92	0.69	1.8
3/8	6x19 IWRC	2.0	1.5	4.1
1/2	6x19 IWRC	3.6	2.7	7.2
5/8	6x19 IWRC	5.6	4.2	11.0
3/4	6x19 IWRC	8.0	6.0	16.0
7/8	6x19 IWRC	11.0	8.1	21.0
1	6x19 IWRC	14.0	10.0	28.0
1 1/8	6x19 IWRC	18.0	13.0	35.0
1 1/4	6x37 IWRC	21.0	15.0	41.0
1 3/8	6x37 IWRC	25.0	19.0	50.0
1 1/2	6x37 IWRC	29.0	22.0	59.0

* These values only apply when the D/d ratio is 5 or greater where:

D = Diameter of curvature around which rope is bent.

d = Diameter of rope body.

TABLE D-14
RATED CAPACITIES FOR CABLE LAID ENDLESS SLINGS - MECHANICAL JOINT 7x7x7 AND 7x7x19
CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE 7x6x19 IWRC CONSTRUCTION
IMPROVED PLOW STEEL GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
				
Dia. (Inches)	Constr.	Vertical	Choker	Vertical Basket*
1/4	7x7x7	0.83	0.62	1.6
3/8	7x7x7	1.8	1.3	3.5
1/2	7x7x7	3.0	2.3	6.1
5/8	7x7x7	4.5	3.4	9.1
3/4	7x7x7	6.3	4.7	12.0
5/8	7x7x19	4.7	3.5	9.5
3/4	7x7x19	6.7	5.0	13.0
7/8	7x7x19	8.9	6.6	18.0
1	7x7x19	11.0	8.5	22.0
1 1/8	7x7x19	14.0	10.0	28.0
1 1/4	7x7x19	17.0	12.0	33.0
3/4	7x6x19 IWRC	6.2	4.7	12.0
7/8	7x6x19 IWRC	8.3	6.2	16.0
1	7x6x19 IWRC	10.0	7.9	21.0
1 1/8	7x6x19 IWRC	13.0	9.7	26.0
1 1/4	7x6x19 IWRC	16.0	12.0	31.0
1 3/8	7x6x19 IWRC	18.0	14.0	37.0
1 1/2	7x6x19 IWRC	22.0	16.0	43.0

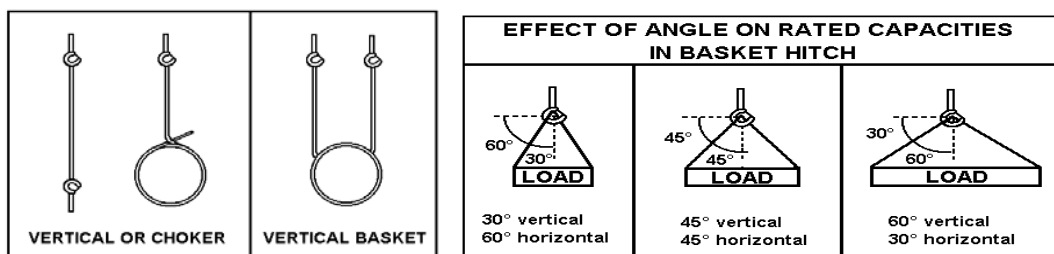
* These values only apply when the D/d ratio is 5 or greater where:

D = Diameter of curvature around which cable body is bent.

d = Diameter of cable body.

WAC 296-24-29431 (Cont.)

TABLE D-15
RATED CAPACITIES
CARBON STEEL AND STAINLESS STEEL
METAL MESH SLINGS



Heavy Duty-10 Ga 35 Spirals/Ft of sling width					
SLING WIDTH IN INCHES					
2	1,500	3,000	2,600	2,100	1,500
3	2,700	5,400	4,700	3,800	2,700
4	4,000	8,000	6,900	5,600	4,000
6	6,999	12,000	10,400	8,400	6,000
8	8,000	16,000	13,800	11,300	8,000
10	10,000	20,000	17,000	14,100	10,000
12	12,000	24,000	20,700	16,900	12,000
14	14,000	28,000	24,200	19,700	14,000
16	16,000	32,000	27,700	22,600	16,000
18	18,000	36,000	31,100	25,400	18,000
20	20,000	40,000	34,600	28,200	20,000
Medium Duty-12 Ga 43 Spirals/Ft of sling width					
2	1,350	2,700	2,300	1,900	1,400
3	2,000	4,000	3,500	2,800	2,000
4	2,700	5,400	4,700	3,800	2,700
6	4,500	9,000	7,800	6,400	4,500
8	6,000	12,000	10,400	8,500	6,000
10	7,500	15,000	13,000	10,600	7,500
12	9,000	18,000	15,600	12,700	9,000
14	10,500	21,000	18,200	14,800	10,500
16	12,000	24,000	20,800	17,000	12,000
18	13,500	27,000	23,400	19,100	13,500
20	15,000	30,000	26,000	21,200	15,000
Light Duty-14 Ga 59 Spirals/Ft of sling width					
2	900	1,800	1,600	1,300	900
3	1,400	2,800	2,400	2,000	1,400
4	2,000	4,000	3,500	2,800	2,000
6	3,000	6,000	5,200	4,200	3,000
8	4,000	8,000	6,900	5,700	4,000
10	5,000	10,000	8,600	7,100	5,000
12	6,000	12,000	10,400	8,500	6,000
14	7,000	14,000	12,100	9,900	7,000
16	8,000	16,000	13,900	11,300	8,000
18	9,000	18,000	15,600	12,700	9,000
20	10,000	20,000	17,300	14,100	10,000

WAC 296-24-29431 (Cont.)

TABLE D-16
MANILA ROPE SLINGS

TABLE D-16: Part 1--Eye and Eye Sling

Eye and Eye Sling							
Rope Diameter Nominal in Inches	Nominal Weight per 100 ft. in Pounds	Vertical Hitch	Choker Hitch	Basket Hitch			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	7.5	480	240	960	830	680	480
9/16	10.4	620	310	1,240	1,070	875	620
5/8	13.3	790	395	1,580	1,370	1,120	790
3/4	16.7	970	485	1,940	1,680	1,370	970
13/16	19.5	1,170	585	2,340	2,030	1,650	1,170
7/8	22.5	1,390	695	2,780	2,410	1,970	1,390
1"	27.0	1,620	810	3,240	2,810	2,290	1,620
1 1/16	31.3	1,890	945	3,780	3,270	2,670	1,890
1 1/8	36.0	2,160	1,080	4,320	3,740	3,050	2,160
1 1/4	41.7	2,430	1,220	4,860	4,210	3,440	2,430
1 5/16	47.9	2,700	1,350	5,400	4,680	3,820	2,700
1 1/2	59.9	3,330	1,670	6,660	5,770	4,710	3,330
1 5/8	74.6	4,050	2,030	8,100	7,010	5,730	4,050
1 3/4	89.3	4,770	2,390	9,540	8,260	6,740	4,770
2"	107.5	5,580	2,790	11,200	9,660	7,890	5,580
2 1/8	125.0	6,480	3,240	13,000	11,200	9,160	6,480
2 1/4	146.0	7,380	3,690	14,800	12,800	10,400	7,380
2 1/2	166.7	8,370	4,190	16,700	14,500	11,800	8,370
2 5/8	190.8	9,360	4,680	18,700	16,200	13,200	9,360

See Figures D-4 and D-5 for sling configuration description.

WAC 296-24-29431 (Cont.)

TABLE D-16: Part 2--Endless Sling

Endless Sling							
Basket Hitch							
Rope Diameter Nominal in Inches	Nominal Weight per 100 ft. in Pounds	Vertical Hitch	Choker Hitch	90°	Angle of Rope to Horizontal		30°
				60°	45°	60°	
				0°	Angle of Rope to Vertical		60°
				30°	45°	60°	
1/2	7.5	865	430	1,730	1,500	1,220	865
9/16	10.4	1,120	560	2,230	1,930	1,580	1,120
5/8	13.3	1,420	710	2,840	2,460	2,010	1,420
3/4	16.7	1,750	875	3,490	3,020	2,470	1,750
13/16	19.5	2,110	1,050	4,210	3,650	2,980	2,110
7/8	22.5	2,500	1,250	5,000	4,330	3,540	2,500
1"	27.0	2,920	1,460	5,830	5,050	4,120	2,920
1 1/16	31.3	3,400	1,700	6,800	5,890	4,810	3,400
1 1/8	36.0	3,890	1,940	7,780	6,730	5,500	3,890
1 1/4	41.7	4,370	2,190	8,750	7,580	6,190	4,370
1 5/16	47.9	4,860	2,430	9,720	8,420	6,870	4,860
1 1/2	59.9	5,990	3,000	12,000	10,400	8,480	5,990
1 5/8	74.6	7,290	3,650	14,600	12,600	10,300	7,290
1 3/4	89.3	8,590	4,290	17,200	14,900	12,100	8,590
2"	107.5	10,000	5,020	20,100	17,400	14,200	10,000
2 1/8	125.0	11,700	5,830	23,300	20,200	16,500	11,700
2 1/4	146.0	13,300	6,640	26,600	23,000	18,800	13,300
2 1/2	166.7	15,100	7,530	30,100	26,100	21,300	15,100
2 5/8	190.8	16,800	8,420	33,700	29,200	23,800	16,800

See Figures D-4 and D-5 for sling configuration description.

WAC 296-24-29431 (Cont.)

TABLE D-17
NYLON ROPE SLINGS

TABLE D-17: Part 1--Eye and Eye Slings

Eye and Eye Sling							
Rope Diameter Nominal In Inches	Nominal Weight per 100 ft. In Pounds	Vertical Hitch	Choker Hitch	Basket Hitch			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	6.5	635	320	1,270	1,100	900	635
9/16	8.3	790	395	1,580	1,370	1,120	790
5/8	10.5	1,030	515	2,060	1,780	1,460	1,030
3/4	14.5	1,410	705	2,820	2,440	1,990	1,410
13/16	17.0	1,680	840	3,360	2,910	2,380	1,680
7/8	20.0	1,980	990	3,960	3,430	2,800	1,980
1"	26.0	2,480	1,240	4,960	4,300	3,510	2,480
1 1/16	29.0	2,850	1,430	5,700	4,940	4,030	2,850
1 1/8	34.0	3,270	1,640	6,540	5,660	4,620	3,270
1 1/4	40.0	3,710	1,860	7,420	6,430	5,250	3,710
1 5/16	45.0	4,260	2,130	8,520	7,380	6,020	4,260
1 1/2	55.0	5,250	2,630	10,500	9,090	7,420	5,250
1 5/8	68.0	6,440	3,220	12,900	11,200	9,110	6,440
1 3/4	83.0	7,720	3,860	15,400	13,400	10,900	7,720
2"	95.0	9,110	4,560	18,200	15,800	12,900	9,110
2 1/8	109.0	10,500	5,250	21,000	18,200	14,800	10,500
2 1/4	129.0	12,400	6,200	24,800	21,500	17,500	12,400
2 1/2	149.0	13,900	6,950	27,800	24,100	19,700	13,900
2 5/8	168.0	16,000	8,000	32,000	27,700	22,600	16,000

See Figures D-4 and D-5 for sling configuration description.

WAC 296-24-29431 (Cont.)

TABLE D-17: Part 2--Endless Slings

Endless Sling							
Rope Diameter Nominal In Inches	Nominal Weight per 100 ft. In Pounds	Vertical Hitch	Choker Hitch	Basket Hitch			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	6.5	1,140	570	2,290	1,980	1,620	1,140
9/16	8.3	1,420	710	2,840	2,460	2,010	1,420
5/8	10.5	1,850	925	3,710	3,210	2,620	1,850
3/4	14.5	2,540	1,270	5,080	4,400	3,590	2,540
13/16	17.0	3,020	1,510	6,050	5,240	4,280	3,020
7/8	20.0	3,560	1,780	7,130	6,170	5,040	3,560
1"	26.0	4,460	2,230	8,930	7,730	6,310	4,460
1 1/16	29.0	5,130	2,570	10,300	8,890	7,260	5,130
1 1/8	34.0	5,890	2,940	11,800	10,200	8,330	5,890
1 1/4	40.0	6,680	3,340	13,400	11,600	9,450	6,680
1 5/16	45.0	7,670	3,830	15,300	13,300	10,800	7,670
1 1/2	55.0	9,450	4,730	18,900	16,400	13,400	9,450
1 5/8	68.0	11,600	5,800	23,200	20,100	16,400	11,600
1 3/4	83.0	13,900	6,950	27,800	24,100	19,700	13,900
2"	95.0	16,400	8,200	32,800	28,400	23,200	16,400
2 1/8	109.0	18,900	9,450	37,800	32,700	26,700	18,900
2 1/4	129.0	23,300	11,200	44,600	38,700	31,600	23,300
2 1/2	149.0	25,000	12,500	50,000	43,300	35,400	25,000
2 5/8	168.0	28,800	14,400	57,600	49,900	40,700	28,800

See Figures D-4 and D-5 for sling configuration description.

WAC 296-24-29431 (Cont.)

TABLE D-18
POLYESTER ROPE SLINGS

TABLE D-18: Part 1--Eye and Eye Slings

Eye and Eye Sling							
Rope Diameter Nominal In Inches	Nominal Weight per 100 ft. In Pounds	Vertical Hitch	Choker Hitch	Basket Hitch			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	8.0	635	320	1,270	1,100	900	635
9/16	10.2	790	395	1,580	1,370	1,120	790
5/8	13.0	990	495	1,980	1,710	1,400	990
3/4	17.5	1,240	620	2,480	2,150	1,750	1,240
13/16	21.0	1,540	770	3,080	2,670	2,180	1,540
7/8	25.0	1,780	890	3,560	3,080	2,520	1,780
1"	30.5	2,180	1,090	4,360	3,780	3,080	2,180
1 1/16	34.5	2,530	1,270	5,060	4,380	3,580	2,530
1 1/8	40.0	2,920	1,460	5,840	5,060	4,130	2,920
1 1/4	46.3	3,290	1,650	6,580	5,700	4,650	3,290
1 5/16	52.5	3,710	1,860	7,420	6,430	5,250	3,710
1 1/2	66.8	4,630	2,320	9,260	8,020	6,550	4,630
1 5/8	82.0	5,640	2,820	11,300	9,770	7,980	5,640
1 3/4	98.0	6,710	3,360	13,400	11,600	9,490	6,710
2"	118.0	7,920	3,960	15,800	13,700	11,200	7,920
2 1/8	135.0	9,110	4,460	18,200	15,800	12,900	9,110
2 1/4	157.0	10,600	5,300	21,200	18,400	15,000	10,600
2 1/2	181.0	12,100	6,050	24,200	21,000	17,100	12,100
2 5/8	205.0	13,600	6,800	27,200	23,600	19,200	13,600

See Figures D-4 and D-5 for sling configuration description.

WAC 296-24-29431 (Cont.)

TABLE D-18: Part 2--Endless Slings

Endless Sling							
Rope Diameter	Nominal Weight per 100 ft. In Pounds	Vertical Hitch	Choker Hitch	Basket Hitch			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
Nominal Inches				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	8.0	1,140	570	2,290	1,980	1,620	1,140
9/16	10.2	1,420	710	2,840	2,460	2,010	1,420
5/8	13.0	1,780	890	3,570	3,090	2,520	1,780
3/4	17.5	2,230	1,120	4,470	3,870	3,160	2,230
13/16	21.0	2,770	1,390	5,540	4,800	3,920	2,770
7/8	25.0	3,200	1,600	6,410	5,550	4,530	3,200
1"	30.5	3,920	1,960	7,850	6,800	5,550	3,920
1 1/16	34.5	4,550	2,280	9,110	7,990	6,440	4,550
1 1/8	40.0	5,260	2,630	10,500	9,100	7,440	5,260
1 1/4	46.3	5,920	2,960	11,800	10,300	8,380	5,920
1 5/16	52.5	6,680	3,340	13,400	11,600	9,450	6,680
1 1/2	66.8	8,330	4,170	16,700	14,400	11,800	8,330
1 5/8	82.0	10,200	5,080	20,300	17,600	14,400	10,200
1 3/4	98.0	12,100	6,040	24,200	20,900	17,100	12,100
2"	118.0	14,300	7,130	28,500	24,700	20,200	14,300
2 1/8	135.0	16,400	8,200	32,800	28,400	23,200	16,400
2 1/4	157.0	19,100	9,540	38,200	33,100	27,000	19,100
2 1/2	181.0	21,800	10,900	43,600	37,700	30,800	21,800
2 5/8	205.0	24,500	12,200	49,000	42,400	34,600	24,500

See Figures D-4 and D-5 for sling configuration description.

WAC 296-24-29431 (Cont.)

TABLE D-19
POLYPROPYLENE ROPE SLINGS

TABLE D-19: Part 1--Eye and Eye Slings

Eye and Eye Sling							
Rope Diameter Nominal In Inches	Nominal Weight per 100 ft. In Pounds	Vertical Hitch	Choker Hitch	Basket Hitch			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	4.7	645	325	1,290	1,120	910	645
9/16	6.1	780	390	1,560	1,350	1,100	780
5/8	7.5	950	475	1,900	1,650	1,340	950
3/4	10.7	1,300	650	2,600	2,250	1,840	1,300
13/16	12.7	1,520	760	3,040	2,630	2,150	1,520
7/8	15.0	1,760	880	3,520	3,050	2,490	1,760
1"	18.0	2,140	1,070	4,280	3,700	3,030	2,140
1 1/16	20.4	2,450	1,230	4,900	4,240	3,460	2,450
1 1/8	23.7	2,800	1,400	5,600	4,850	3,960	2,800
1 1/4	27.0	3,210	1,610	6,420	5,560	4,540	3,210
1 5/16	30.5	3,600	1,800	7,200	6,240	5,090	3,600
1 1/2	38.5	4,540	2,270	9,080	7,860	6,420	4,540
1 5/8	47.5	5,510	2,760	11,000	9,540	7,790	5,510
1 3/4	57.0	6,580	3,290	13,200	11,400	9,300	6,580
2"	69.0	7,760	3,980	15,900	13,800	11,300	7,760
2 1/8	80.0	9,330	4,670	18,700	16,200	13,200	9,330
2 1/4	92.0	10,600	5,300	21,200	18,400	15,000	10,600
2 1/2	107.0	12,200	6,100	24,400	21,100	17,300	12,200
2 5/8	120.0	13,800	6,900	27,600	23,900	19,600	13,800

See Figures D-4 and D-5 for sling configuration description.

WAC 296-24-29431 (Cont.)

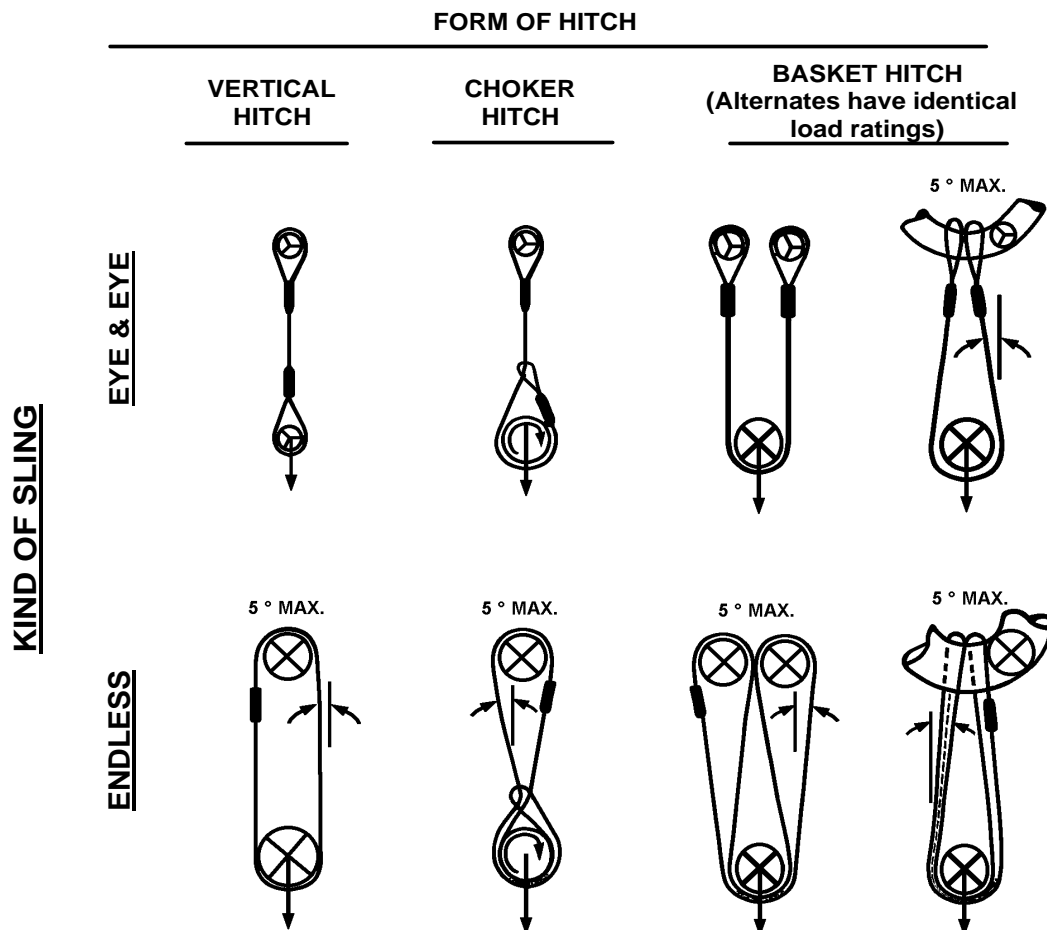
TABLE D-19: Part 2--Endless Slings

Endless Sling							
Basket Hitch							
Rope Diameter Nominal In Inches	Nominal Weight per 100 ft. In Pounds	Vertical Hitch	Choker Hitch	Angle of Rope to Horizontal			
				90°	60°	45°	30°
				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	4.7	1,160	580	2,320	2,010	1,640	1,160
9/16	6.1	1,400	700	2,810	2,430	1,990	1,400
5/8	7.5	1,710	855	3,420	2,960	2,420	1,710
3/4	10.7	2,340	1,170	4,680	4,050	3,310	2,340
13/16	12.7	2,740	1,370	5,470	4,740	3,870	2,740
7/8	15.0	3,170	1,580	6,340	5,490	4,480	3,170
1"	18.0	3,850	1,930	7,700	6,670	5,450	3,860
1 1/16	20.4	4,410	2,210	8,820	7,640	6,240	4,410
1 1/8	23.7	5,040	2,520	10,100	8,730	7,130	5,040
1 1/4	27.0	5,780	2,890	11,600	10,000	8,170	5,780
1 5/16	30.5	6,480	3,240	13,000	11,200	9,170	6,480
1 1/2	38.5	8,170	4,090	16,300	14,200	11,600	8,170
1 5/8	47.5	9,920	4,960	19,800	17,200	14,000	9,920
1 3/4	57.0	11,800	5,920	23,700	20,500	16,800	11,800
2"	69.0	14,300	7,160	28,700	24,800	20,300	14,300
2 1/8	80.0	16,800	8,400	33,600	29,100	23,800	16,800
2 1/4	92.0	19,100	9,540	38,200	33,100	27,000	19,100
2 1/2	107.0	22,000	11,000	43,900	38,000	31,100	22,000
2 5/8	120.0	24,800	12,400	49,700	43,000	35,100	24,800

See Figures D-4 and D-5 for sling configuration description.

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**FIGURE D-4
BASIC SLING CONFIGURATIONS WITH VERTICAL LEGS**



NOTES: Angles 5° or less from the vertical may be considered vertical angles.

For slings with legs more than 5° off vertical, the actual angle as shown in Figure D-4 must be considered.

EXPLANATION OF SYMBOLS: Minimum Diameter of Curvature

Represents a contact surface which shall have a diameter of curvature at least double the diameter of the rope.

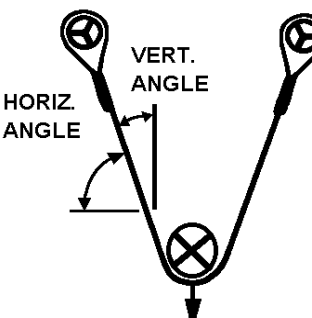
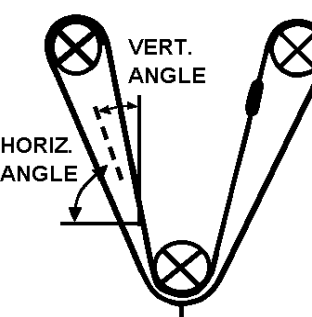
Represents a contact surface which shall have a diameter of curvature at least 8 times the diameter of the rope.

Represents a load in a choker hitch and illustration the rotary force on the load and/or the slippage of the rope in contact with the load.

Diameter of curvature of load surface shall be at least double the diameter of the rope.
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FIGURE D-5
Sling Configuration with Angled Legs

		FORM OF HITCH		
		VERTICAL HITCH	CHOKER HITCH	BASKET HITCH (Alternates have identical load ratings)
KIND OF SLING	EYE & EYE	NOT APPLICABLE	NOT APPLICABLE	
	ENDLESS	NOT APPLICABLE	NOT APPLICABLE	

Notes: For vertical angles of 5° or less, refer to Figure D-4 “basic sling configuration with vertical legs.” See Figure D-4 for explanation of symbols.

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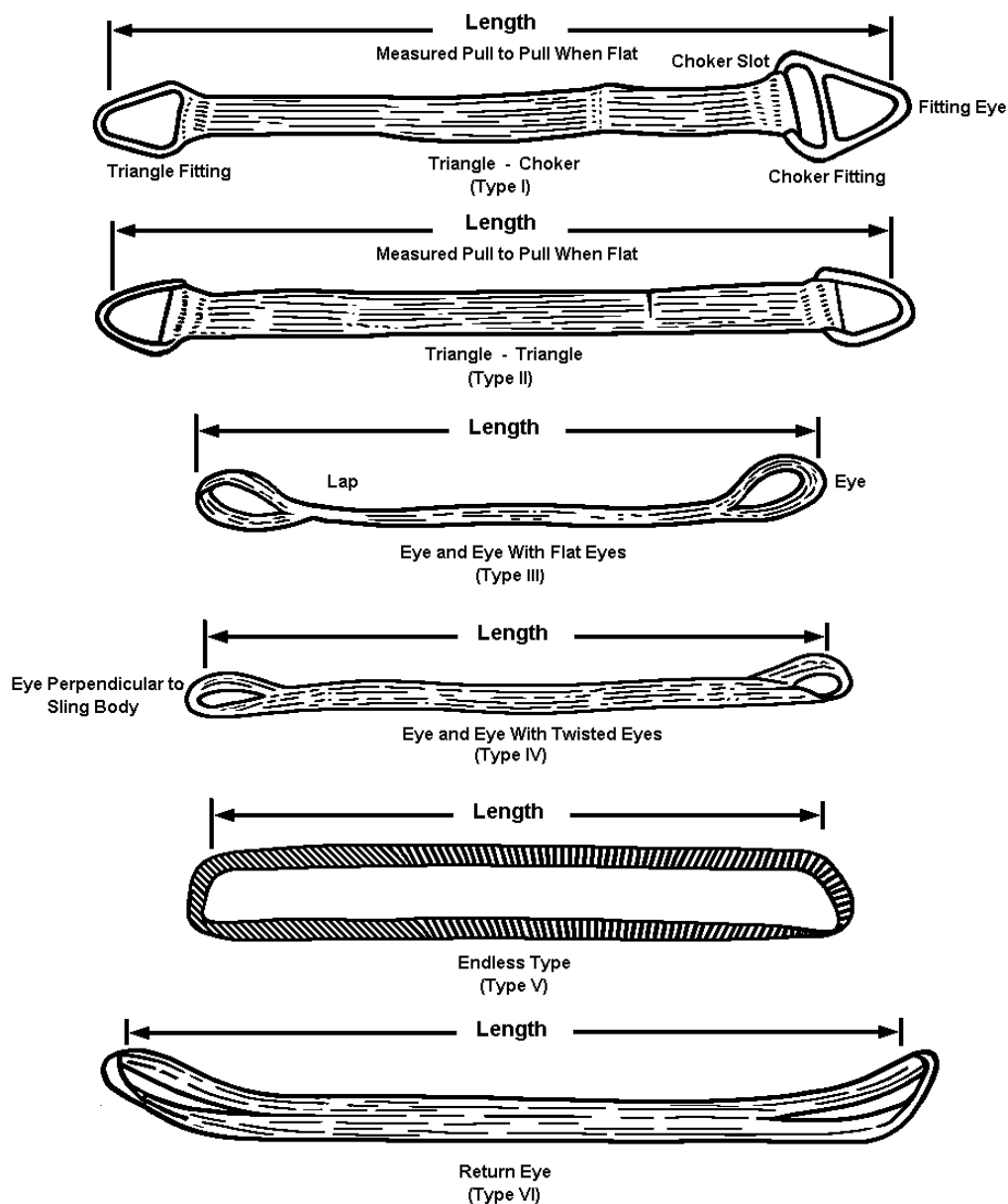


FIGURE D-6
Basic Synthetic Web Sling Constructions

WAC 296-24-29431 (Cont.)

TABLE D-20
RATED CAPACITY IN POUNDS SYNTHETIC WEB SLINGS 1,000 LBS.
PER INCH OF WIDTH SINGLE PLY

(Table D-20: Part 1--Types I, II, III, and IV)
Triangle - Choker Slings, Type I
Triangle - Triangle Slings, Type II
Eye & Eye with Flat Eye Slings, Type III
Eye & Eye with Twisted Eye Slings, Type IV

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,000	750	2,000	1,700	1,400	1,000
2	2,000	1,500	4,000	3,500	2,800	2,000
3	3,000	2,200	6,000	5,200	4,200	3,000
4	4,000	3,000	8,000	6,900	5,700	4,000
5	5,000	3,700	10,000	8,700	7,100	5,000
6	6,000	4,500	12,000	10,400	8,500	6,000

Notes:

1. All angles shown are measured from the vertical.
2. Capacities for intermediate widths not shown may be obtained by interpolation.

TABLE D-20 (PART 2 -- TYPE V)

Endless Slings, Type V

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,600	1,300	3,200	2,800	2,300	1,600
2	3,200	2,600	6,400	5,500	4,500	3,200
3	4,800	3,800	9,600	8,300	6,800	4,800
4	6,400	5,100	12,800	11,100	9,000	6,400
5	8,000	6,400	16,000	13,900	11,300	8,000
6	9,600	7,700	19,200	16,600	13,600	9,600

Notes:

1. All angles shown are measured from the vertical.
2. Capacities for intermediate widths not shown may be obtained by interpolation.

TABLE D-20 (PART 3 -- TYPE VI)

Return Eye Slings, Type VI

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	800	650	1,600	1,400	1,150	800
2	1,600	1,300	3,200	2,800	2,300	1,600
3	2,400	1,950	4,800	4,150	3,400	2,400
4	3,200	2,600	6,400	5,500	4,500	3,200
5	4,000	3,250	8,000	6,900	5,650	4,000
6	4,800	3,800	9,600	8,300	6,800	4,800

Notes:

1. All angles shown are measured from the vertical.
2. Capacities for intermediate widths not shown may be obtained by interpolation.

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**TABLE D-21
RATED CAPACITY IN POUNDS SYNTHETIC WEB SLINGS 1,200 LBS.
PER INCH OF WIDTH SINGLE PLY**

Table D-21: (Part 1--Types I, II, III and IV)

Triangle - Choker Slings, Type I
Triangle - Triangle Slings, Type II
Eye & Eye with Flat Eye Slings, Type III
Eye & Eye with Twisted Eye Slings, Type IV

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,200	900	2,400	2,100	1,700	1,200
2	2,400	1,800	4,800	4,200	3,400	2,400
3	3,600	2,700	7,200	6,200	5,100	3,600
4	4,800	3,600	9,600	8,300	6,800	4,800
5	6,000	4,500	12,000	10,400	8,500	6,000
6	7,200	5,400	14,400	12,500	10,200	7,200

Notes:

1. All angles shown are measured from the vertical.
2. Capacities for intermediate widths not shown may be obtained by interpolation.

TABLE D-21 (PART 2 -- TYPE V)

Endless Slings , Type V

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,900	1,500	3,800	3,300	2,700	1,900
2	3,800	3,000	7,600	6,600	5,400	3,800
3	5,800	4,600	11,600	10,000	8,200	5,800
4	7,700	6,200	15,400	13,300	10,900	7,700
5	9,600	7,700	19,200	16,000	13,600	9,600
6	11,500	9,200	23,000	19,900	16,300	11,500

Notes:

1. All angles shown are measured from the vertical.
2. Capacities for intermediate widths not shown may be obtained by interpolation.

TABLE D-21 (PART 3 -- TYPE VI)

Return Eye Slings, Type VI

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	950	750	1,900	1,650	1,350	950
2	1,900	1,500	3,800	3,300	2,700	1,900
3	2,850	2,250	5,700	4,950	4,050	2,850
4	3,800	3,000	7,600	6,600	5,400	3,800
5	4,750	3,750	9,500	8,250	6,750	4,750
6	5,800	4,600	11,600	10,000	8,200	5,800

Notes:

1. All angles shown are measured from the vertical.
2. Capacities for intermediate widths not shown may be obtained by interpolation.

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TABLE D-22
RATED CAPACITY IN POUNDS SYNTHETIC WEB SLINGS 1,600 LBS.
PER INCH OF WIDTH SINGLE PLY

Table D-22: (Part 1--Types I, II, III and IV)
Triangle - Choker Slings, Type I

Triangle - Triangle Slings, Type II
Eye & Eye with Flat Eye Slings, Type III
Eye & Eye with Twisted Eye Slings, Type IV

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,600	1,200	3,200	2,800	2,300	1,600
2	3,200	2,400	6,400	5,500	4,500	3,200
3	4,800	3,600	9,600	8,300	6,800	4,800
4	6,400	4,800	12,800	11,100	9,000	6,400
5	8,000	6,000	16,000	13,800	11,300	8,000
6	9,600	7,200	19,200	16,600	13,600	9,600

Notes:

- All angles shown are measured from the vertical.*
- Capacities for intermediate widths not shown may be obtained by interpolation.*

TABLE D-22 (PART 2 -- TYPE V)

Endless Slings , Type V

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	2,600	2,100	5,200	4,500	3,700	2,600
2	5,100	4,100	10,200	8,800	7,200	5,100
3	7,700	6,200	15,400	13,300	10,900	7,700
4	10,100	8,200	20,400	17,700	14,400	10,200
5	12,800	10,200	25,600	22,200	18,100	12,800
6	15,400	12,300	30,800	26,700	21,800	15,400

Notes:

- All angles shown are measured from the vertical.*
- Capacities for intermediate widths not shown may be obtained by interpolation.*

TABLE D-22 (PART 3 -- TYPE VI)

Return Eye Slings, Type VI

Sling Body Width, Inches	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,050	1,050	2,600	2,250	1,850	1,300
2	2,600	2,100	5,200	4,500	3,700	2,600
3	3,900	3,150	7,800	6,750	5,500	3,900
4	5,100	4,100	10,200	8,800	7,200	5,100
5	6,400	5,150	12,800	11,050	9,050	6,400
6	7,700	6,200	15,400	13,300	10,900	7,700

Notes:

- All angles shown are measured from the vertical.*
- Capacities for intermediate widths not shown may be obtained by interpolation.*

[Order 76-6, § 296-24-29431, filed 3/1/76.]